

creative computing

1985

Buyer's Guide To Personal Computers & Peripherals

In-Depth Evaluations:

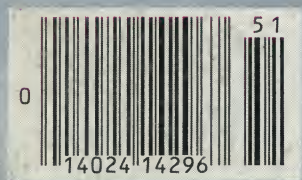
- Hewlett-Packard Portable**
- Apple Macintosh**
- IBM PCjr**
- Epson QX10**
- Eagle PC Plus 2**
- Kaypro 10**
- Sord IS-11**
- Cromenco C-10**
- Corvus Concept**
- HP 150**
- ACT Apricot**
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**Computer
Comparison
Chart**



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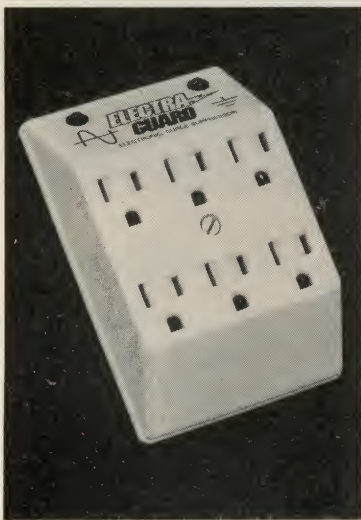
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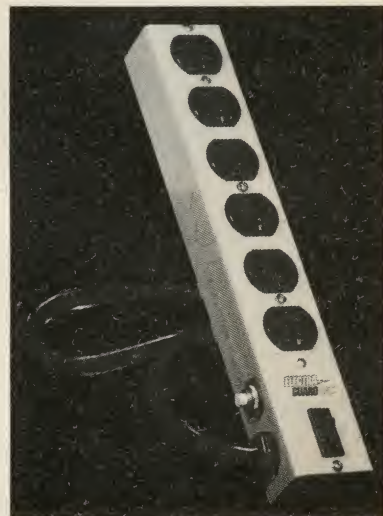
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Buyer's Guide To Personal Computers & Peripherals

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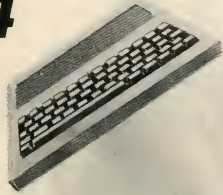
The *Creative Computing Buyer's Guide To Personal Computers & Peripherals* is published annually by Ahl Computing, Inc., 39 East Hanover Ave., Morris Plains, NJ 07950, also publishers of *Creative Computing* magazine and the *Creative Computing Software Buyer's Guide*.

Ahl Computing, Inc. is a subsidiary of Ziff-Davis Publishing Company, One Park Ave., New York, NY 10016. Richard Friese, president; Selwyn Taubman, treasurer; Bertram A. Abrams, secretary.

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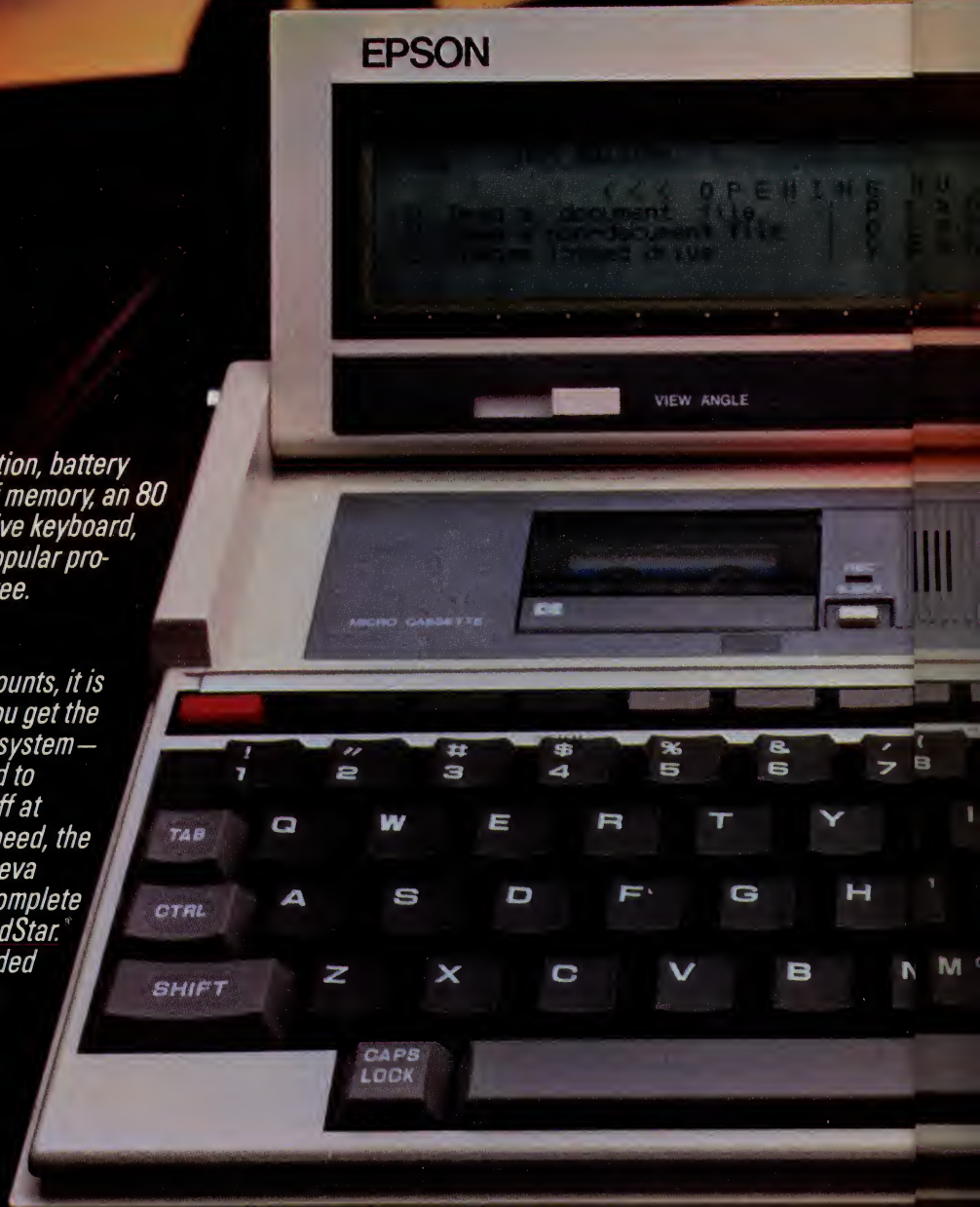
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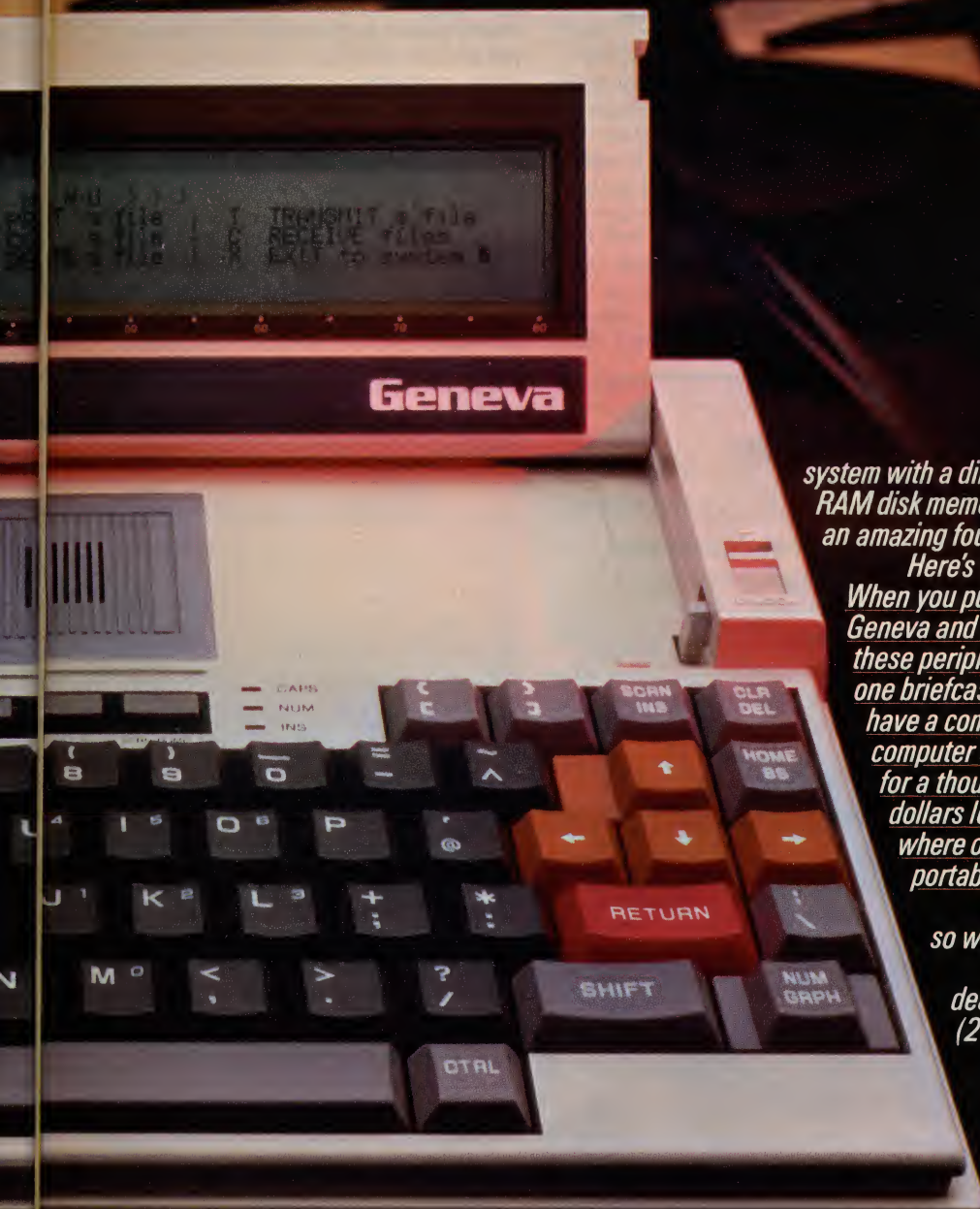
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G E N E V A

Hewlett Packard Portable

Inching Closer to the Perfect Portable

When the Hewlett Packard HP 110 showed up at the lab, I was agog. I had heard that HP was going to do a notebook portable, but was totally unprepared for what I saw.

We have seen a heck of a lot of notebook machines around here, and some of them have been rather impressive. We really *use* notebook machines here (the first draft of this piece was composed on one), and we know how they stack up.

So I'll quit the buildup and move straight to the central theme: the HP 110 is quite simply the finest notebook computer available on the market today.

John J. Anderson

It doesn't attempt to impress with \$5000 plasma displays or touch screens or mice or icons or even the sexiest designer styling you will ever see. It offers instead sheer power—more power than nine out of ten current desk-top systems by my thumbnail accounting—and the sexiest ROM software you have ever imagined.

The 110 offers unbelievable set of specifications in an off-white box 13"

wide by 10" deep by 2-7/8" high, weighing 9 lbs. 2 oz. I dare say you may have trouble suspending disbelief at a description of the features of the HP 110. It sports a CMOS (complementary metal oxide semiconductor) 8086 microprocessor. This a true 16-bit microprocessor with a 16-bit data bus. It runs at a clock rate of 5.33 megaHertz. That is fast.

The HP 110 features 272K of non-volatile CMOS RAM. That means that you can turn the machine off and a trickle charge keeps your information intact within RAM memory. Another 8K



HARDWARE PROFILE

Name: Hewlett Packard HP 110
Type: Portable microcomputer
CPU: CMOS 8086, 16-bit
RAM: 272 K
ROM: 384K
Keyboard: 75-Key Selectric-style
half-stroke



Operating System: MS-DOS 2.11 in ROM

Display Resolution: 80 characters by 16 lines, 128 x 140 pixels

Ports: HP-1L, HP-1B, serial RS-232, printer, modular phone

Dimensions: 13" x 10" x 3", 9 lbs.

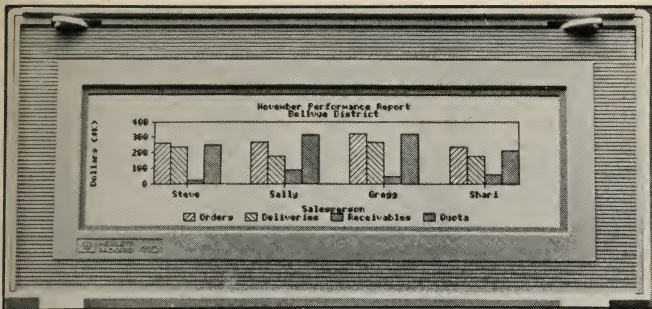
Documentation: Preliminary at time of evaluation.

Summary: The most powerful self-contained portable computer system ever offered.

Price: \$2995

Manufacturer:

Hewlett Packard
19420 Homestead Rd.
Cupertino, CA 95014
(408) 725-8111



Lotus 1-2-3 software comes built into the HP 110.



The keyboard. Note linear cursor key placement.

of RAM is dedicated to the screen display. This is a highly legible LCD screen at 80 characters by 16 rows. With twice the horizontal and vertical resolution of the Model 100, the HP 110 display makes a Model 100 screen seem positively claustrophobic. (In fairness, although the Model 100 makes an excellent yardstick, it is probably unfair to compare it point for point with the HP 110. The 110 beats it cold and also costs four times as much.)

How they crammed all this stuff into such a pretty little case is beyond me. I wanted to take a screwdriver to it, but had second thoughts. Not only is it rude to dismantle a prototype on the first date, but a mishap could end in tragedy. So we'll follow up with a look inside the HP 110 at a later date.

And legible LCD display? Talk to me about legible LCD displays. The font is not only clear but extremely handsome with thick and thin strokes that emulate a printed typeface. The 110 can plot 480 by 128 pixels in the bit-mapped mode, and screen contrast is controllable directly from the keyboard.

It features 384K of CMOS ROM. These are not typos, folks. Another 8K of ROM is devoted to configuration and serial number.

What is nearly 400K of ROM used for? Well, an utterly complete version of Lotus 1-2-3 resides inside the machine, for one thing. That is the number one selling integrated spreadsheet, statistical graphics, and information management package. Also in ROM are *MemoMaker*, a full-function word processor; *Personal Applications Manager* (a menu-based MS-DOS shell); and a terminal communications package.

In addition to this built-in software, there is the MS-DOS 2.11 operating system. This makes reams of existing software, including programs from the HP 150 touchscreen desktop computer (reviewed in the April issue of *Creative Computing*), a distinctly compatible possibility. It also makes the HP 110 compatible with other MS-DOS machines, like uh, the IBM PC, for example.

And because all this software resides

in ROM there is more RAM room left to these applications on the HP 110 than most any other machines on which you might imagine running them.

The keyboard is a half-stroke, Selectric-style 75-key matrix, with eight special-function keys. We shall take a closer look at the keyboard up ahead.

Power is supplied by three semi-permanently installed, lead/acid D-cell batteries. Lead/acids charge faster and hold that charge longer than nicads. The light, compact power adapter supplied with the unit provides AC power and/or recharge juice for the D-cells. Battery life is estimated at 16 hours of continu-

**The HP 110 is
absolutely the sturdiest
portable we have
seen to date.**

ous use on a full charge. Of course, if you use the batteries on a less stringent duty cycle, they can last much longer before requiring a recharge. CMOS memory can be retained for a solid year while the unit is off. The cells themselves are rated at five years of service life.

From the main applications menu, you get an automatic display of battery condition. If power drops to less than 1.5 hours, a low battery indication is displayed every eight minutes. If the power dips below five percent, the machine shuts itself off and can be powered back on only when the AC adapter is attached and functioning.

As you might have extrapolated in your growing awe by now, a modem is indeed built-in to the unit as well. It is a 300 baud direct-connect modem with auto-answer and auto-dial, and it is capable of producing both pulse and tone dial signals. It functions smoothly and simply with the built-in telecommunications software.

The system also sports a built-in

clock/calendar, of course, with calendar capability through December 31, 2079. After that you'll require a ROM update. Clock resolution is to a tenth of a second, with an accuracy of two minutes per month under normal conditions. Multiple alarm and appointment keeping functions are provided. Whenever an application ruler is invoked, the time appears near the center of it—a very nice touch.

In addition to all these features, it must be mentioned that the HP 110 is absolutely the sturdiest portable we have seen to date. While we did not drop test it from a height of three feet onto a concrete floor, we were told that the 110 can withstand a 100-g force on all six sides. It will withstand operating temperature extremes of 32 to 115 degrees Fahrenheit (0 to 45 degrees Celsius). If it gets hotter or colder, best to shut it off and shove off.

For scientists and technicians on-site, the HP 110 is probably the first practical means of bringing a serious and powerful computer *to the problem* as opposed to the other way around. It is built to withstand tough field conditions that no other portable would survive over term.

Hewlett Packard has always had very exacting quality standards for its hardware, and the Model 110 is in no way an exception. But the story just begins with the Model 110 itself.

Perfect Portable Peripherals

A special machine deserves a special mass storage device, and the HP 110 will have one. The HP 9114 disk drive unit is a Sony-format 3½" hard-shell floppy, capable of storing about 630K per double-sided disk. And the unique fact setting the 9114 apart is that it sports an internal battery pack as well, making it the first self-powered and self-contained professional disk drive unit.

One battery charge will see you through six to eight hours of use, depending on the duty cycle. The dimensions of the unit are 11½" x 8" x 3", at a weight of a mere 5 lbs. 9 oz. The transfer rate is 6K per second maximum with an average access time of 497 milliseconds.

The 9114 drive is still very much in

prototype, and so we did not get a chance to do more than read about it, as you are doing. There is no doubt, however, that HP will make good on the promise to deliver—probably around the time you read this.

In the meantime, you can connect existing HP floppy drives to the HP 110 using the HP-IL bus, standardized for HP hardware. This makes daisy-chaining of interface loop peripherals trivial. Additionally, the HP 110 contains a standard RS-232C interface for setting up serial devices, and provisions to interface with HP-IB peripherals as well.

Because RAM memory is partitioned into theoretical silicon drives A and B, external drives are referenced beginning with drive C.

As soon as we receive an HP 9114 at the lab for testing, we will provide a follow-up evaluation. At press time we had no pricing information on the unit.

Turning On

Remove the HP 110 from its handsome protective carrying case and snap open the lid just as you would a fine attaché. Adjust the physical angle of the screen to the optimal viewing angle (it will counterbalance to stay at any position you set). Press any key to activate the display. Adjust LCD contrast directly from the keyboard.

You will be presented with the Personal Applications Manager menu. This, and all the ROM software on the Model 110, is menu-driven, using either the eight function keys, or directional highlighting, to make a selection from the menu. At any and all points within P.A.M., Memomaker, Lotus, and the terminal communications package, you are presented with or can call menus to delineate all your options.

Even more significantly, I have never seen a portable computer with anything

remotely approaching the level of help that the Model 110 offers. Quite a lot of code can be packed into 384K of ROM—more ROM, incidentally, than any micro-computer has used before, and help screens get their share of silicon. At any point within any program, you can call up the specific helps you desire. I was able to get going with all the ROM software without any recourse to accompanying documentation. All the documentation you need is right alongside you, on-line. How very refreshing.

Of course 1-2-3 is a complex program, and to make the best use of it, my recommendation is to turn to the manual.

And as far as the other pieces of software go, the on-line documentation is all you need. I learned how to create and store documents, save telecommunications configuration files, set the clock/calendar as well as set alarms, and set up directories, all within a couple of hours,



HP 110 vs. Sharp PC-5000



The most obvious comparison to be made with currently available portables would be to match up the features of the HP 110 with those of the Sharp PC-5000.

Both machines offer an 80-column flip-up LCD display, MS-DOS compatibility, built-in modem, ROM software, and a carrying weight in the neighborhood of 10 lbs.

The Sharp unit cannot match the basic specs of the HP 110, but then it must be noted that it is \$500 cheaper with modem (\$2350) than the HP machine. Without the modem feature, the PC-5000 lists for \$1995.

The HP 110 offers 272K of CMOS RAM, while the PC-5000 offers "only" 128K, expandable to 256K. The PC-5000 has a "mere" 192K of ROM, as compared with the HP's whopping 384K. The Sharp uses a "hot" 8088 microprocessor, with an 8-bit data bus, while the HP uses a CMOS 8086, for true 16-bit operation.

The most significant difference between the two machines is probably in the area of screen size: the Sharp sports

an 80-column by 8 line display, while the HP 110 offers 80 columns by 16 lines. On this account the HP is without question the winner. The difference may not sound like much, but it makes a very big difference indeed during use.

We did not confirm the theory, but in a torture-test competition, we feel confident that the HP would outlast the Sharp by a wide margin. The Sharp machine does not seem to have been designed with punishment in mind. The HP, on the other hand, comes from a long line of machines built to military specifications.

But there are more than a couple of areas where the Sharp PC-5000 manages to come out on top of the HP. For another \$400, you can get your PC-5000 with a built-in 80-column dot-matrix impact printer, and system weight then reaches only 12 lbs! The modem unit is unique and includes a module that can be used as a voice handset.

HP could learn a bit about keyboards from the handsome, sculpted keyboard offered on the Sharp machine. It clearly

has a superior feel to that of the Model 110. Unfortunately, neither machine makes use of directional function keys. So far the NEC 8201 seems the only portable to get high marks on that score.

Probably the most significant advantage of the Sharp machine is its RAM cartridge capacity. Open a neat little door on the front on the unit, and pop in or out a 128K bubble memory cartridge. These cartridges can hold applications programs as well as operating systems and user data, just like a floppy disk. On the road, this arrangement is more compact and convenient than floppies. Of course if floppy drives are what you want, you can have those too.

The PC-5000 also comes with Basic in ROM and an audio cassette port.

The Sharp PC-5000 is just becoming available in this country, and if it can be distributed successfully, might pose the greatest competition to Hewlett Packard in the category of high-end portables. For a full review of the Sharp machine, see the January 1984 issue of *Creative Computing*.

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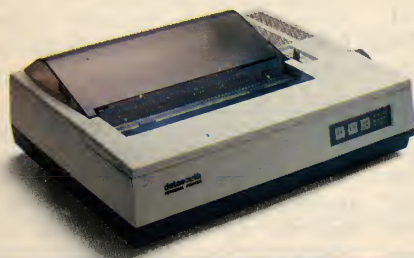


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Technically speaking, the Personal Printer is “Epson compatible.” But it’s better than the competing Epson because it also does letter-quality printing.

Personally speaking, the Personal Printer is “checkbook compatible.” So you don’t have to sacrifice the money you need to get the printer you want. And it comes in two models—one with a 10-inch and one with a 17-inch carriage.

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A battery-powered version of HP's ThinkJet personal printer and the battery-powered HP 9114 disk drive.

and without any recourse to the photocopied preliminary documentation that accompanied our prototype unit.

So the ROM software on the 110 is very easy to use. While it does not have the show-and-tell user interface of the Macintosh, its operation is logical, consistent, and easily mastered. The P.A.M. is designed to be user-configurable. You can load and access the program you want to in the way you want to upon power-up.

But, as no programming language is offered in ROM, you will have to transport one from another machine or from retail disk. I am not a real Basic freak, but I missed the presence of Basic on the HP 110. I would have liked to have made a project of transporting it over from its consanguineous pal, the HP 150, but time restrictions precluded such ambitious plans.

As a result, we were unable to run the Ahl Benchmark on the Model 110. Nor, therefore, will you be designing your own P.A.M. applications right off the bat. Perhaps the inclusion of Basic in ROM would have been a smart move.

But, if you're a Pascalian, Forthright, Logotype, or Lispian, you will be glad to hear that no ROM has been wasted on Basic, and you may airlift in your language of choice.

I did not spend a great amount of time with MemoMaker, but it seems a very serviceable word processor. It is scaled down from its HP 150 debut version and works very nicely on the 110 display.

As with the Model 100, you can gain maximum screen space by clicking off the menu ruler once you have an idea what the function keys can do for you.

Not having worked with any very large files on MemoMaker, I cannot speak for its utility in handling the very big jobs. Judging by its format and its name, I would not recommend writing a novel on it, though I am quite sure you

could. However, I think that HP is betting that most Model 110 MemoMaker files will be 25 pages or less, and I would agree with them on this judgement. And MemoMaker works very well on this size document.

The terminal package is excellent, and I spent a couple of enjoyable late evening

I have never seen a portable computer with anything remotely approaching the level of help that the Model 110 offers.

sessions with the Model 110 on CompuServe. As mentioned above, you can save sets of terminal configurations, including phone number, log-on string, and terminal parameters. Then all you have to type is CSERVE, for example, and the Model 110 will autodial your local access number, put you on-line, send your log-on string, and set you down gently into full duplex. Uploading and downloading of files is straightforwardly menu-driven. And if you get into trouble, the ever-present help screens are at hand.

One of the most convenient features of the HP 110, and one I have always missed on my Model 100, is the ability to set multiple alarms from the clock calendar. Simply define a special file from MemoMaker, indicating the times dates, and messages you would like to include with the alarms. Then, whether the machine is on or off, a pleasant electronic alarm will sound at the preset date and time.

If the machine is off when the alarm

sounds, the message will automatically be displayed. If you are working with the computer when the alarm sounds, you are offered the option of moving to the alarm message screen. You can turn off the alarm by hitting a key or it will shut down automatically after about 12 seconds. Up to 16 alarm presets can be set simultaneously.

You can also use alarms to invoke special programs at special times. I would assume that the electronic speaker can be made to beep, hum, or chirp under user control as well.

Hewlett Packard has also announced an initial release of optional software available on 3½" disks. These include:

- Microsoft *MultiPlan*, a multi-purpose electronic spreadsheet.
- Microsoft *Chart*, a presentation graphics package.
- *MicroPlan*, a financial package from Chang Labs.
- Microsoft *Basic*.
- Microsoft *Compiled Basic*.
- Microsoft *Pascal*.
- Microsoft *Fortran*.
- Microsoft *Cobol*.
- MicroPro *WordStar*, the classic word processing program.
- MicroPro *MailMerge*, multipurpose file merging program
- MicroPro *SpellStar*, *WordStar* spelling checker.
- Microsoft *Word*, word processing program.
- Ashton-Tate *dBase II*, a relational database management tool.
- Ashton-Tate *Friday*, an information management tool.
- Link Systems *Datafax*, an electronic notebook program.
- Link Systems *Datalink PC*, a telecommunications software package.
- Dow Jones Market Analyzer, a financial portfolio management package.
- Dow Jones Investment Evaluator, an investment analysis package.

Among the entertainment packages that will be available on disk for the HP 110 is the *Zork* series of adventures from Infocom.

I would have liked to comment on the documentation that will accompany the release system package, but all material we received was extremely preliminary. I cannot comment at all on the final documentation based on what was supplied with the prototype unit.

We recently got a letter from an angry Grid owner, who took exception to the comment that the 110 was the ultimate portable. My response was to the effect that for the cost of a Grid Compass (\$8000+) I'd rather buy an HP 110 along with a Toyota Tercel to act as a carrying case. I'll put it this way: if you have \$3000 to spend on a portable, nothing else comes close.

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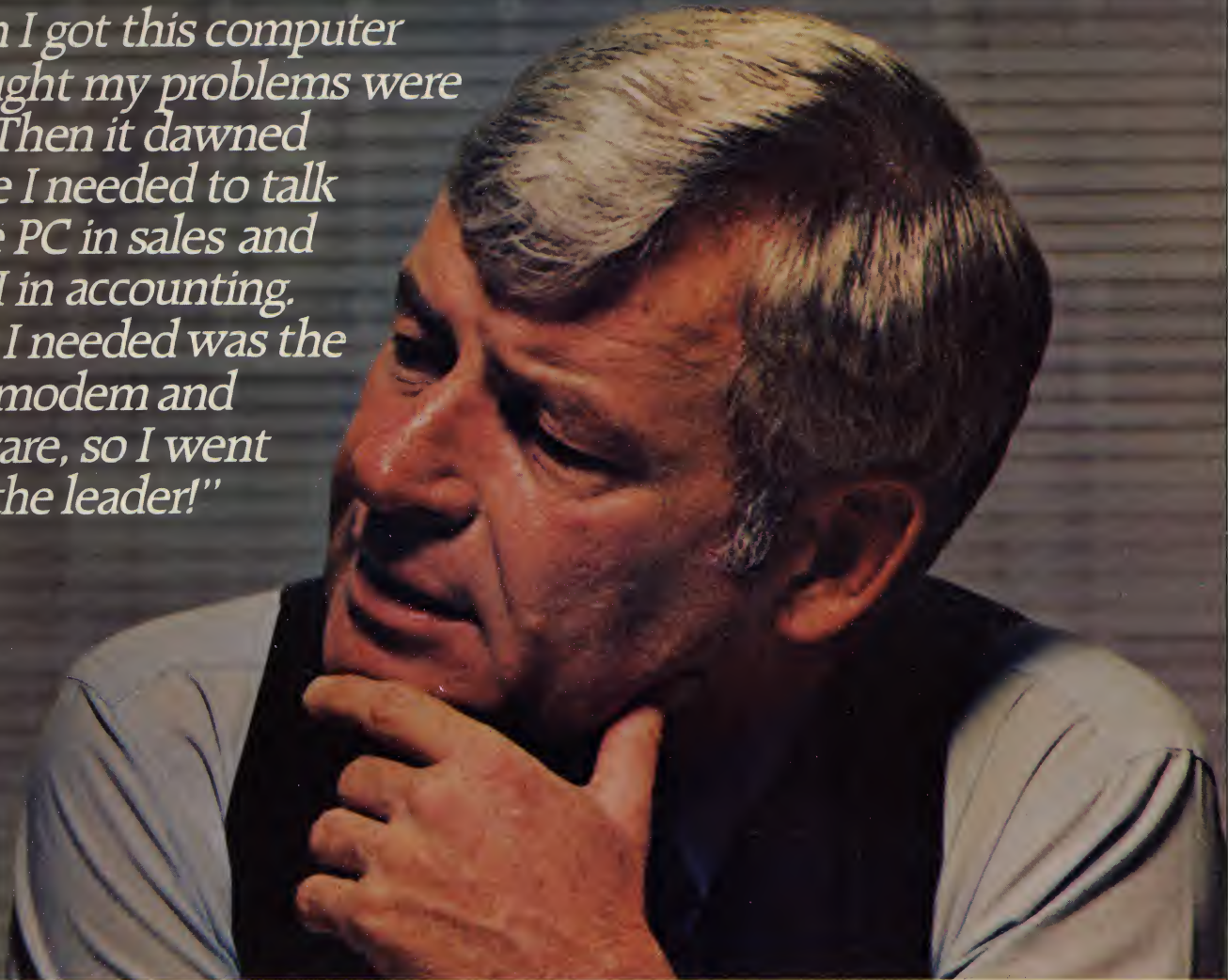
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CIRCLE 109 ON READER SERVICE CARD

MicroOffice RoadRunner

David H. Ahl

Apparently it is in vogue to delete the spaces between two words. We have been noticing this trend increasingly with software packages. But now we have the RoadRunner computer from MicroOffice Systems Technology with *SuperCalc* software. Well, perhaps we are saving lots of bytes of memory by not using those spaces, but, frankly, we don't think readability is enhanced. Be that as it may, the RoadRunner is a new entry in the notebook computer sweepstakes.

Like the Gavilan, the product is being aimed primarily at OEMs and large-volume end users. It probably will not be found on the shelves of your local computer store, at least not by the name RoadRunner. However, one or more OEMs may well market the machine through retail outlets.

On The Outside

The RoadRunner comes in a compact package measuring only 11.5" x 7.8" x 3"

and weighing five pounds. When the display is opened, the machine automatically comes to life with a high-pitched beep and menu on the LCD display.

Opening the computer reveals an 8-line x 80-character LCD display, a standard QWERTY keyboard with 73

full-stroke keys and an extra row of 14 special keys at the top, and four small plug-in slots above the keyboard.

The active portion of the LCD display measures 1.3" x 9.3". It tilts back and forth, but does not have a contrast adjustment for the LCD elements thus making it difficult to read under certain lighting conditions. We were told by



MicroOffice that production models would include a contrast knob.

Characters are quite small on the display, about the same size as dot-matrix printer print. Characters are formed within a 5 x 7 dot matrix with one row of dots between lines; there are no letter descenders. Thus, readability of a full screen of text leaves much to be desired. The screen has 64 x 480 individually addressable pixels.

According to the published specifications, 255 characters can be displayed. Perhaps so, but we ran a short program to display all the CHR\$ characters and counted only 221 different ones. Frankly, that's a nit since the RoadRunner provides all the foreign letters and graphics symbols you would ever want.

Full-Stroke Keyboard

The keyboard has a good feel with no give in the center. The keys are concave sculpted with a matte finish. Alpha-numeric keys are light tan with dark brown markings while control keys are a darker tan. This subtle color scheme is carried throughout giving the RoadRunner an attractive, contemporary appearance.

Unfortunately, MicroOffice has followed the IBM school of keyboard lay-

HARDWARE PROFILE

Product: RoadRunner

Type: Notebook portable computer

CPU: 8-bit CMOS Z80, 2.5 MHz

RAM: 48K (optional 16K and 32K RAM packs)

ROM: 16K

Keyboard: 73 full-stroke keys

Display: LCD, 8 lines x 80 characters

Graphics: 64 x 480 pixels

Ports: Bus extender, RS-232, modem

Dimensions: 11.5" x 7.8" x 3"

Documentation: User's Guide

Summary: Notebook portable with removable memory cartridges, 8-hour battery pack, and CP/M built in. Basic, spreadsheet, and text editor available.

Price: \$1775

Manufacturer:

MicroOffice Systems
Technology, Inc.
35 Kings Highway East
Fairfield, CT 06430
(203) 367-2525



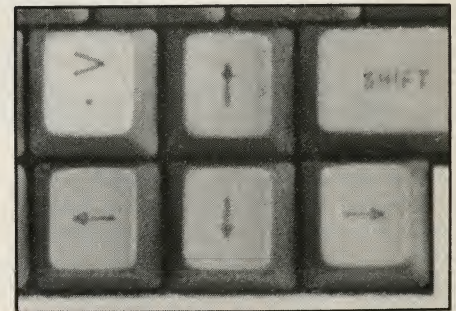
The MicroOffice RoadRunner opened up. In the foreground are a battery pack and two memory cartridges.

out, i.e., pepper the keyboard with extra keys in unexpected places. Next to the M on the bottom row, we expect to find a left arrow, right arrow, question mark, and SHIFT. The RoadRunner puts the up cursor key in place of the question mark (the other three cursor keys are to the right of the spacebar). It is nice that the cursor keys are in a logical pattern, but what an ill-chosen location!

The CMD (control) key is under the right SHIFT and is all-too-easy to press inadvertently bringing on all kinds of undesirable results.

On the other hand, millions of people tolerate, perhaps even like, the keyboard on the IBM PC, so perhaps we are being overly harsh toward this one. Actually, it is more standard than that on the IBM PC, so it is likely that RoadRunner users will adjust after a week or two.

On the top row are several special keys including HELP, SAVE, and MENU (functional in most software packages). Next come eight function keys which have default meanings in most software



Cursor control keys are arranged in a logical pattern, but unfortunately the up cursor key is where the question mark is usually found.

packages, but which also can be set by the user from either Basic or CP/M. Keys to delete, insert, and exit programs are to the right of the top row.

Memory Cartridges

The standard RoadRunner comes with a 16K of ROM and 48K of RAM built in. The built-in ROM contains a CP/M-compatible operating system, and editing, scheduling, phone directory, and terminal emulation (DEC VT100) software.

Four slots labeled A to D are provided above the keyboard into which memory cartridges can be plugged. Cartridges can be blank or contain software. Currently available are 16K blank cartridges; 32K and 64K ones are promised later.

Each cartridge measures just 2.5" square and weighs one ounce. It contains CMOS memory and a lithium battery which will keep the memory refreshed for five years.

Software packages such as Microsoft Basic and Sorcim *SuperCalc* are also available on cartridge.

Each of the four slots is addressed just as though it were a disk drive. Although a 37-pin bus connector is accessible at the back of the machine, no floppy disk unit is available or even promised for the RoadRunner. The design philosophy seems to be that if you need a disk unit, the RoadRunner can easily be connected to another machine—we saw it done with an IBM PC—and data up- and down-loaded through the RS-232 port.

On the Inside

The RoadRunner uses a CMOS version of the Z80A running at 2.5 MHz. Thus, we would expect performance similar to the NEC 8201 and, indeed, the time to run our standard benchmark was virtually identical.

The machine has a real-time clock which can be programmed to "wake up" the computer at a specified time.

Connectors are provided in the rear of the unit for the main bus (for parallel devices, but alas, no printer interface is available), RS-232 serial devices, and modem module.

A battery compartment holds a removable 10-ounce NiCad battery pack. The RoadRunner will run approximately eight hours on a fully-charged battery which we are told will recharge "overnight;" no exact time is given.

Communications

A compact modem module which plugs into the back of the machine is available. It is a 300-baud direct-connect modem with auto-dial, auto-answer, and a wake-up mode of operation. This means, for example, that the computer could be set to wake up at 2:00 a.m. and send the daily sales report back to the computer at the home office.

Built in to the operating software is a terminal emulation mode which imitates a DEC VT100 terminal. In this mode, the computer can talk to many timesharing systems as a hard-wired terminal. It is not likely that one would wish to use the machine in place of a VT100, but this is another way to up- and down-load data from a larger host machine.

Software

As mentioned, the basic RoadRunner comes with a "CP/M 2.2 compatible" operating system. Why not just CP/M 2.2? Because, we are told, the RoadRunner operating system has a background print capability, and regular CP/M does not. However, all (?) CP/M software will run on the machine, as long as there is sufficient memory.

The scheduling and name/address/phone directory capability are similar to those on the Tandy Model 100. We haven't found these especially useful, particularly since they devour memory like crazy, but perhaps other people do. The DEC VT100 terminal emulator is also built in.

Included with the basic machine is a text editing cartridge, MicroOffice 100 Editor. This is a more than adequate text editor. It is always in insert mode (like the Model 100), but it has several unexpected features such as character, word, and line delete, and global search-and-replace.

With the MicroOffice Editor, when the screen is full, it pages up seven lines, so the previous bottom line becomes the top line on the next screen.

The definitions of eight function keys can be toggled on and off on the bottom row of the display. We found the functions understandable and sensible, even without an instruction manual (the ultimate test).

Microsoft Basic is available as an extra-cost (\$200) software package. It is the standard Z80 implementation except that the version we used did not have on-screen editing. The folks at MicroOffice said this may be available later.

Sorcim *SuperCalc* is also available as an extra-cost (\$275) option. We did not have an opportunity to try it out.

MicroOffice tells us that many soft-

ware suppliers are planning to convert their packages to the machine. The availability of CP/M should make this fairly easy, so we would expect to see many more packages in the not too distant future.

Servicing

The RoadRunner comes with the usual 90-day limited warranty. At the moment, no field service facilities are planned. Faulty machines must be mailed back to Fairfield, CT for repair or replacement.

Pricing

The basic RoadRunner with AC charger/adaptor, blank 16K data cartridge, text editor cartridge, soft carrying case, and manual has a suggested list price of \$1775.

The modem module costs \$240; Microsoft Basic, \$200; and Sorcim *SuperCalc*, \$275.

Data cartridges range from \$50-\$300. An extra battery pack costs \$35.

An Office on the Road

MicroOffice positions the RoadRunner as an office on the road, and the description is apt. With the text editor, spreadsheet program, scheduler, and communications capability, you truly have a portable office. With a weight of only five pounds and the compact data cartridges, you will be tempted to carry the machine everywhere.

We wish the keyboard layout could have been more standard and the display could have been larger with more room between the lines and lower-case letter descenders. We would have liked a Centronics parallel printer output too.

On the other hand, MicroOffice has done most things right. Now, how do we become an OEM so we can get a machine of our own?

CIRCLE 469 ON READER SERVICE CARD



When closed, the RoadRunner fits easily into an attaché case.

The Sord Is Mightier Than The Pen



Sord IS-11 Notebook Computer

In contrast to the majority of electronics companies in Japan that were either outgrowths of the military buildup for WWII or established shortly after the war to aid in Japan's thrust to achieve technological supremacy, the history of the Sord Computer Corporation reads more like a Horatio Alger story. The company was established in 1970 by Takayoshi Shiina and his mother for the purpose of writing computer software.

Entrepreneurs are rare in the history of Japanese industry, so Sord is regarded as a maverick and does not seem to be under the protective umbrella of Japan, Inc. (or MITI).

As a result of this involvement with computer applications before getting into the manufacture of hardware, the people at Sord appreciated the need for integrated software long before it became a buzzword in the microcomputer industry. And, as a result of being a maverick, Sord understands the need for savvy marketing.

Put this experience together and what

David H. Ahl

do you get? First, the M23 computer which was introduced into the U.S. market at NCC '83. Rather than a programmer-oriented operating system, the M23 uses PIPS, a no-programming business planning system of integrated software. It has 43 interactive commands such as MT (Make Table), SORT (Sort Data), and CT (Change Title). The system is priced in the \$2000 range.

When this system was first introduced in Japan (in 1980), Sord opened a series of PIPS Inns to teach users how to use the system in day or night classes. The system has been well received in Japan and the U.S.; major customers include Japan Air Lines, Citibank, and several other major banks.

Sord also markets the M68, the first desktop computer to use 256K memory chips. This high end 16/32-bit machine

uses a 68000 cpu running at 10 MHz and an 8-bit Z80A. The basic machine costs about \$5000, while a fully expanded system with 4Mb of internal memory goes for \$13,000 plus.

The "Consultant" Notebook Computer

But enough of desktop computers. Sord has now taken its concept of integrated software and shoehorned it into the IS-11 notebook computer, dubbed the "Consultant."

Upon hearing the hardware specifications at the press conference, we were particularly impressed. The IS-11 has a 8-bit Z80A operating at 3.4 MHz, 32K of RAM (expandable to 64K), eight-line by 40-character LCD display, parallel and RS-232 interfaces, rechargeable NiCd batteries (eight hours of operation per charge), built-in microcassette recorder and 64K of ROM. The last two got our attention, but their full significance did not become apparent until we got out

1985 Creative Computing Buyer's Guide

hands on a machine.

The keyboard is virtually identical to the one on the NEC 8201 (and Radio Shack Model 100) both in feel and number of keys (62 full stroke, 8 function). In other words, it is a good, solid keyboard with a sensible layout. On the other hand, we were disappointed that Sord chose to put the cursor control keys in a horizontal line rather than using the more sensible diamond pattern on the NEC 8201.

Text resolution of the LCD display is eight lines of 40 characters. Measuring 1.4" x 5.6", the display is about 26% smaller than the one on the Model 100; nevertheless, it is quite legible. Graphics resolution is 256 x 64 pixels.

In the upper right corner of the case is a built-in microcassette recorder. Data transfer speed is an amazing 2000 baud, considerably faster than the leisurely rate of the Model 100. A C-30 microcassette can store 128K, a respectable number of programs and pieces of data.

Around the periphery of the housing are several connectors, removable covers, and sliding panels. In the back is found the power switch, LCD angle adjust control, recessed reset switch, AC adapter connector, bar code reader port, serial (modem) port, RS-232 port, parallel port (for CRT and microfloppy disk), and ROM cartridge socket. On the bottom are panels covering connectors for a thermal graphics printer, external numeric keypad, and additional memory.

The IS-11 is nearly identical in size to a Model 100 (11.8" x 8.4" x 1.4"), but at 4 lb. 6 oz., weighs about 8 ounces more.

The IS-11 is available in the basic configuration for \$995 and with a built-in modem for \$100 more. A 40-column thermal printer is \$169. A numeric keypad with 16 additional function keys is \$119. Other peripherals scheduled for release by fall include a bar code reader, a 3½" microfloppy disk drive, and a Basic language interpreter. Prices for these additions have not been set.

Integrated Software

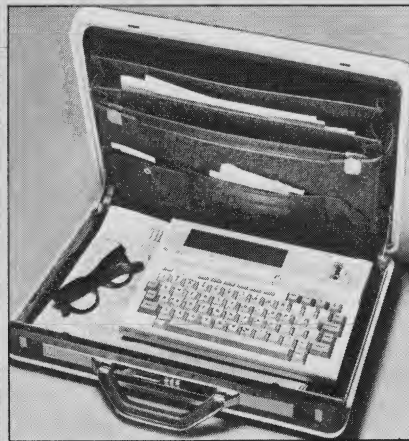
As you might gather from the statement that the unit has 64K of ROM, the IS-11 has a substantial amount of built-in software—and it isn't Basic.

Turn on the machine, and the bottom line of the LCD display shows six "labels" corresponding to the six function keys. They are I-PIPS, I-CALC, I-EDIT, I-COMM, SYSTEM, and HELP.

I-PIPS is a spreadsheet system which keeps data arranged in the usual row and column form. However, I-PIPS has certain features such as searching and the ability to sort data alphabetically that give it the capability of a limited database program as well. Moreover, I-PIPS can automatically draw graphs of data in the worksheet and

1985 Creative Computing Buyer's Guide

HARDWARE PROFILE



Name: IS-11 Consultant

Type: Notebook portable computer

CPU: 8-bit Z80A (3.4 MHz)

RAM: 32K, expandable to 64K

ROM: 64K

Keyboard: 62 full-stroke keys, 8 special keys

Display: LCD, 8 lines x 40 characters

Graphics: 64 x 256 pixels

Mass Storage: Built-in 128K microcassette recorder; optional 3 1/2" floppy disk

Printer: Optional 40-column thermal

Ports: Parallel, RS232 serial

Modem: Optional built-in 300 baud

Dimensions: 11.8" x 8.4" x 1.4"

Documentation: User's Guide

Summary: Notebook portable with built-in integrated software for spreadsheet, limited graphics and database management, text editing, and communications. Accepts up to 64K ROM-pack applications software modules.

Price: \$995 (\$1095 with modem)

Manufacturer:

Sord Computer of America
645 5th Ave.
New York, NY 10022
(212) 759-0140

print them out. Lotus *Symphony*, watch out!

The entire I-PIPS module is menu-driven and is exceptionally easy to use. The menus are organized in layers, with each new layer accessed by a function key. You need not remember any commands (as in most spreadsheet and database packages); instead you use the menu to get to the

desired function. However, if this sounds cumbersome (you are the type who likes shorthand commands), you can execute any command directly by simply typing it on the keyboard. Moreover, you can type out the name of the entire command or just the first letter or two.

Upon selecting I-PIPS, you are presented with the choices Table, Edit, Files, Calc, Dbase, and Help. The next level (after pressing Table) takes you down to Create, Write, Title, Show, and Help. If you then press Create, you are presented with a series of questions about the spreadsheet to be created: filename, data type in each column, column width, column title, and number of rows.

From there on, I-PIPS functions very much like a spreadsheet on a much larger system. You enter data, labels, and formulas. The list of available functions is quite extensive and includes the four arithmetic operations, exponentiation, summation, integer, absolute, trig and log functions, square root, and random number.

You can also insert and delete rows and columns, sort rows and columns (a feature absent from many larger spreadsheets), and retrieve rows based on conditions you specify.

The ability to create graphs is quite nifty. Upon selecting Pie or Bar, a series of questions appear to ask what you want graphed (from and to what row) and the name of the graph. The computer then splits the screen in half and puts the data you specified in the left half and the graph in the right. The process is quick and painless.

All right, you say, it seems to have everything, but does it do windows? Sure. How many windows would you like—two, three, more? The system will produce them although, with a screen this size, two or three is probably all you can realistically use.

I-PIPS has other capabilities as well. Data can be formatted in columns (right, left, or center justified). Rows and columns can be copied from one part of a worksheet to another, or to another worksheet altogether. And, of course, worksheets can be saved or printed. All in all, a most impressive spreadsheet system.

Other Built-in Software

For performing calculations, you select I-CALC. The right portion of the LCD then displays, in a reverse field, a simulated calculator numeric keypad, and your \$1000 IS-11 is transformed into a \$10 calculator—well, perhaps a \$25 calculator.

The calculator mode supports the four arithmetic operations and exponentiation. It has a single register temporary memory, but can also save and retrieve the results of calculations from the permanent memory of the machine.



Microcassette recorder operates at 2000 baud; a C-30 cassette can store 128K of data.

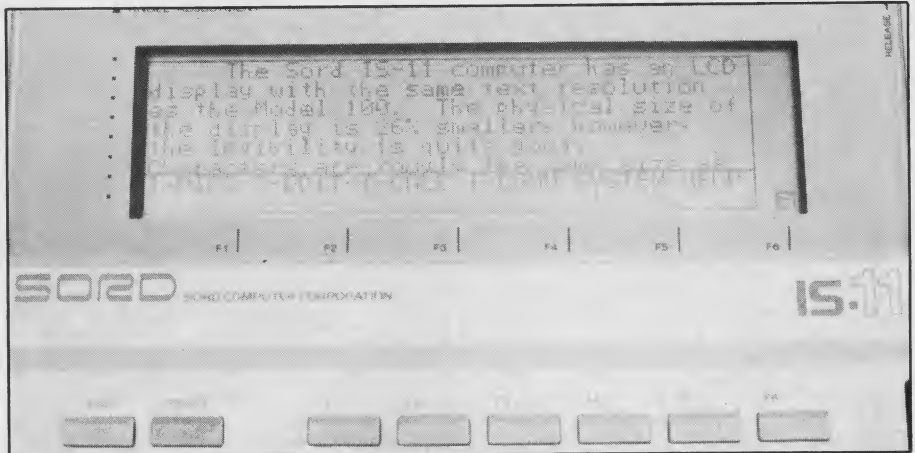
The built-in word processing functions, selected with I-EDIT, are similar to those found on the NEC 8201 and Model 100 and are suitable for basic text entry, editing, and printing. In addition, a word processing ROM-pack (I-WP) is available and offers more advanced functions such as cut and paste, word search and replace, and print formatting.

The communications capability is selected with I-COMM. Using an RS-232C interface, this module permits you to transmit and receive data from another computer or on-line database.

Applications Software

In addition to the integrated software, Sord plans to release generic application software in ROM-pack form. Packages in the works include: Sales-pack, Financial-pack, Business Security-pack, Time-Sharing Systems-pack, and Data Entry-pack. No details are available about these yet.

Perhaps more exciting is the ability of



LCD display shows eight lines of 40 characters each. Display is 26% smaller than the Model 100, but is quite legible. Sord IS-11 can display windows. Here, word processing text (top) is overlaid by function key definitions (bottom).

the IS-11 to accept custom 64K ROM-packs from third-party software suppliers and value added resellers. This capability

We see the inclusion of the microcassette in the IS-11 as a nice marriage of the most attractive capabilities of the Epson HX-20 and the 8201/Model 100.

should attract many outside suppliers to make and market software for the IS-11.

Moreover, the built-in 128K micro-

cassette recorder can be used for data storage, thus opening up many applications that are not possible on the 8201 or Model 100. We see the inclusion of the microcassette in the IS-11 as a nice marriage of the most attractive capabilities of the Epson HX-20 and the 8201/Model 100.

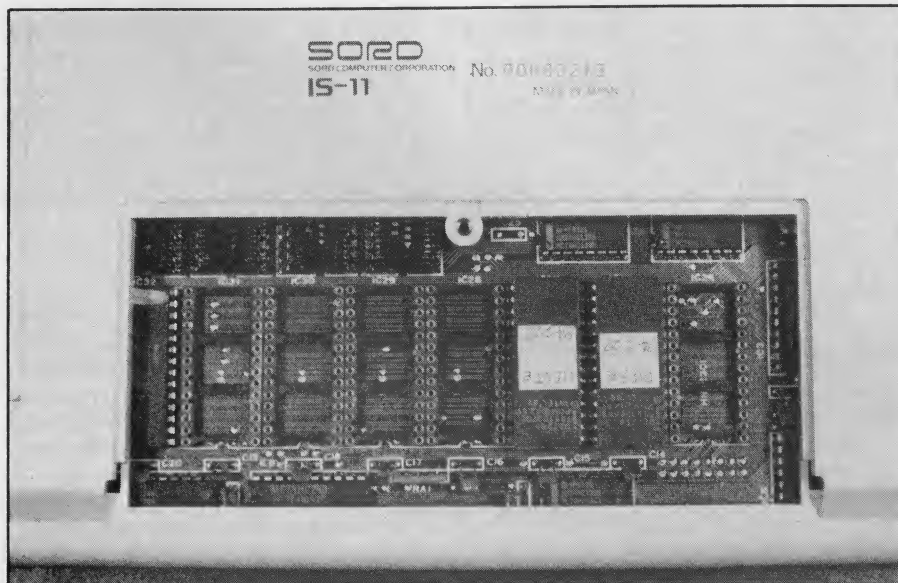
Thermal Printer

An optional thermal printer (PT-11) styled similarly to the IS-11 is available. This plugs into the side of the computer. It prints 40-character lines and reproduces full dot (pixel) graphics (320 dots per line). Print speed is 25 characters per second. Like other thermal printers, the PT-11 is completely silent.

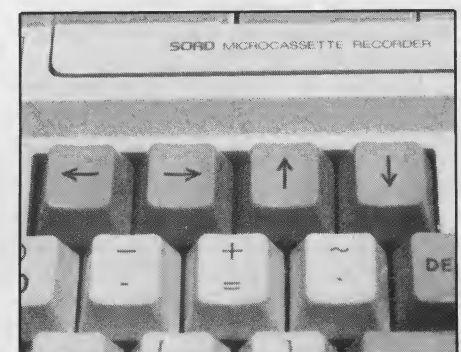
The IS-11 can print the contents of the screen using the HCOPY command. In addition, all of the software modules have a print routine included.

The Next Step

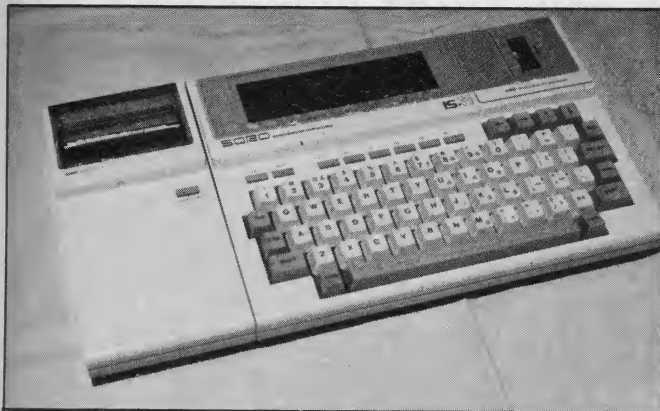
The Sord IS-11 Consultant is not a breakthrough on any front. Yet with its integrated software, it is a big step beyond the other systems currently available. We have seen compact computers with full-stroke keyboards, 40-column by 8-line displays, and microcassette records—but never all in one unit.



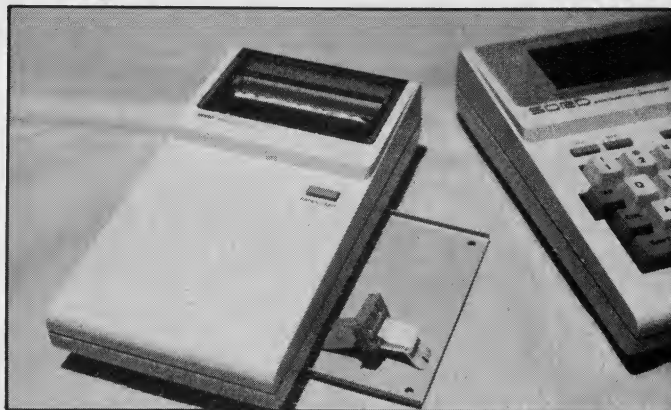
Removal of bottom cover reveals sockets for memory expansion.



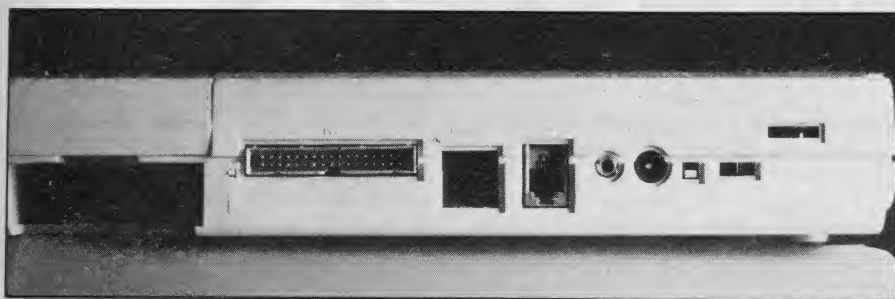
Unfortunately, the cursor control keys are arranged in a horizontal line.



Optional 40-column thermal graphics printer attaches to left side of computer.



Printer attaches easily with connector and sliding door.

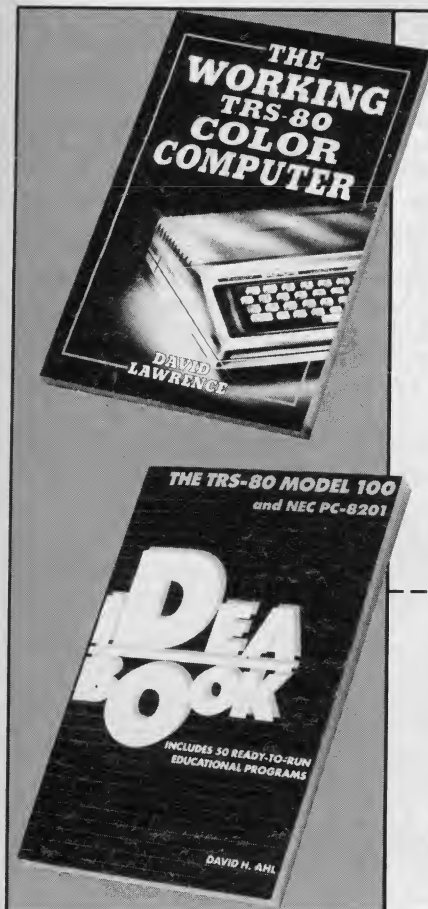


Back of unit has connectors for RS-232 device, telephone jack (if optional modem is installed), parallel device, bar code reader, and AC adapter.

We have seen computers with built-in spreadsheet software (Workslate), text editing, communications, and rudimentary database software—but again, never all in one unit. And we have seen machines with plug-in ROM capability.

The main attraction of the IS-11 is not the hardware—indeed the LCD display is smaller than several of its competitors—but the integration of all the important computing functions in one, compact unit. At \$995, the Sord IS-11 Consultant should be a best seller.

CIRCLE 470 ON READER SERVICE CARD



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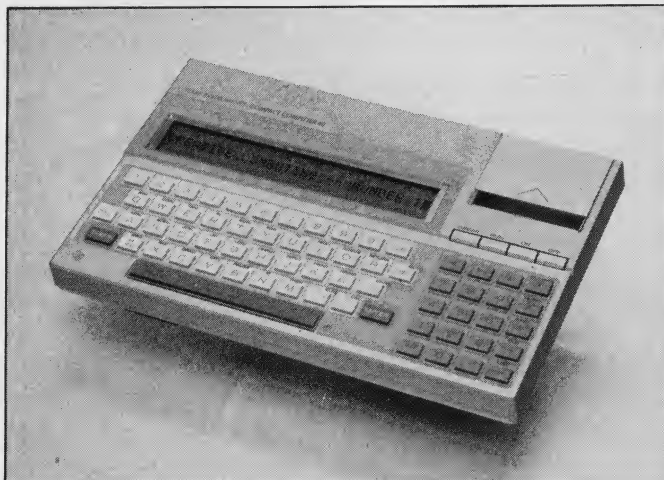
Nine Nifty Notebook Computers

Since the introduction of the first pocket computers more than two years ago and the first transportables about two years ago, we have been avidly following the developments in the field. We have reviewed a cross section of these computers on the pages of *Creative Computing*.

This section is not intended to be an exhaustive, in-depth review of the computers. Rather, it contains a description of each machine including impressions from our review of it or from the comments of other users.

Texas Instruments CC-40

The Texas Instruments Compact Computer 40 (CC-40) bridges the gap



Texas Instruments CC-40

David H. Ahl

between the pocket and notebook categories. It has one of the best versions of Basic ever offered by TI and provides exceptional accuracy, albeit rather slowly.

The CC-40 is powered by four AA alkaline batteries which will last for 200 hours of use, considerably longer than most other notebook machines. If you prefer, an AC adapter is also available.

Although the keyboard is arranged in the standard QWERTY layout, it is only two-thirds the size of a standard keyboard and sports calculator-style keys. Thus, touch typing is not possible, and even experienced typists will find a two-finger approach more reliable. For data entry, a numeric keypad is provided to

the right of the main keyboard.

The CC-40 uses a single line, 31-character display capable of reproducing upper- and lowercase text and a variety of graphics symbols. The display scrolls horizontally on a maximum 80-character line. The LCD screen also displays several special status indicators above and below the main text line, so it is more versatile than it might appear.

As it comes out of the box, the CC-40 does not interface to anything directly—not even a cassette recorder. However, an eight-pin connector attaches to a hex-bus peripheral module. This unit provides an interface to three peripherals, an RS-232 interface, a printer/plotter, and a wafertape drive. On the top of the CC-40 is a cartridge port that can accept ROM cartridge software or a memory expansion cartridge.

TI has announced a wide variety of



Casio FP-200



Radio Shack Model 100



NEC PC-8201

software packages on both wafertape and ROM cartridges. The packages tend to be adaptations of programmable calculator software and will have greatest appeal for engineers and financial analysts.

The most likely market for the TI CC-40 is probably as a competitor to pocket computers and as an upgrade from programmable calculators. In this market with its low price tag (frequently discounted to under \$250), it is a formidable competitor.

CIRCLE 471 ON READER SERVICE CARD

Casio FP-200

Casio is a very successful maker of calculators, watches, and electronic musical keyboards. However, their previous forays into computers have ended in failure, at least in the U.S. With the FP-200, they have taken a different approach and may be able to carve out their own niche in the market.

The FP-200 is primarily a spreadsheet machine and runs a built-in software package called CETL (Casio Easy Table Language). It is a *VisiCalc*-like language, and anyone familiar with another spreadsheet will be able to use it immediately. Also built-in is Casio Basic, a Microsoft-like implementation with rather leisurely performance.

The FP-200 is built around a CMOS version of the Z80 and has 32K of ROM and 8K of RAM, expandable to 32K. External mass storage requires either a cassette tape recorder (300 baud) or a 70K single-sided, single-density floppy disk drive. Output ports are also provided for a parallel printer and RS-232 serial device such as a modem.

The FP-200 has an 8-line x 20 character display. For graphics, 64 x 160 pixels can be individually addressed.

The keyboard is full-size, but uses calculator-style short-throw keys. It has 57 alphanumeric keys, four special keys, five function keys (two meanings each),

and four cursor keys (arranged in a straight line). An optional, external numeric keypad is available.

The FP-200 would be a good choice if you are looking for a machine primarily for spreadsheet calculations and some Basic programming. The keyboard renders it unsuitable for word processing, even if there were software available which there is not. Several utility software packages (sort/merge, statistics, graphics) are promised and would further enhance the utility of the machine.

The suggested retail price is \$499, but we have yet to see a machine in any retail outlets.

CIRCLE 472 ON READER SERVICE CARD

Radio Shack Model 100

The story of the Radio Shack TRS-80 Model 100 is actually not the story of a TRS-80 at all. The machine was conceived by a small Japanese company, Kyoto Ceramics and first sold in Japan by NEC. Radio Shack designers worked with Kyocera to incorporate certain changes and additional features in the computer before introducing it in the American market. These changes were apparently "right," as few other computers have enjoyed such runaway sales success as the Model 100.

The Model 100 is truly notebook size (8.5" x 12" x 2.2") and weighs just under four pounds. It incorporates a full-size, full-stroke keyboard, with four special keys, eight function keys, and four cursor keys (in an unfriendly straight line).

The display is the largest on any notebook computer, 2" x 7.5", and displays eight lines of 40 characters each. The character size is large and legible. Graphics within a 64 x 240 pixel matrix are also possible. A built-in speaker plays notes over a five-octave range.

The Model 100 uses a CMOS version of the Z80 running at 2.5 MHz. Since default mode in Basic is double pre-

cision, the machine was very slow in running our benchmark; on the other hand, it scored high in the accuracy department. It has only 8K of RAM built in, but a 24K version is available. Both can be further expanded to 32K. An external cassette recorder provides mass storage.

The computer provides an impressive array of I/O ports. On the back are connectors for Centronics parallel printer, RS-232 serial device, cassette recorder, bar code reader, and modular telephone jack.

The Model 100 has a built-in direct-connect modem which can plug into any telephone jack. Coupled with the communications software package, it provides many of the features of a so-called "smart" modem—auto-dial, log-on, download, and upload—although it does not have wake up and auto-answer.

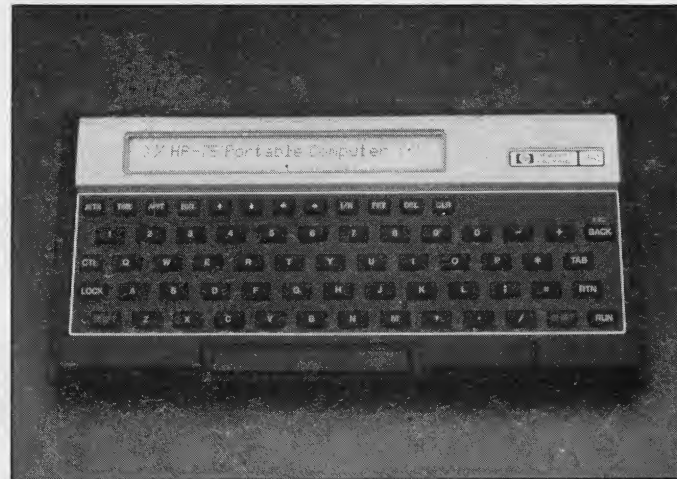
The Model 100 has five programs built in. Microsoft Basic is missing a few commands and does not have on-screen editing (except by means of the text editor, a cumbersome process). The text editor is an adequate package. It is always in insert mode, and has cut, paste, search, and other rudimentary features. It does not have an output formatter, but several are available from third party vendors.

The communications package was mentioned above. The last two packages, schedule organizer and name/address organizer, are simply special versions of the text editor with certain commands locked out. We have not found them particularly useful.

Many software packages have been introduced already by third party vendors, and much more is on the way. The availability of software coupled with the integrated packages built into the machine make the Model 100 an attractive choice for a wide variety of users. Poor Basic program editing and lack of an output formatter are small drawbacks



Teleram 3000



Hewlett Packard HP-75C

against the many enticing capabilities of the computer coupled with an attractive price.

CIRCLE 473 ON READER SERVICE CARD

NEC PC-8201

We have frequently called the NEC PC-8201 the twin of the Radio Shack Model 100. Strictly speaking, this is not true. The 8201 was born six months or so earlier in Japan and is a somewhat different version of the Kyoto Ceramics original.

The 8201 is slightly larger than the Model 100 as a result of providing a slot in the left side for an expansion memory cartridge. The 8201 can have from 16K to 64K of RAM in the basic machine. The 32K plug-in memory cartridges function as a switchable bank of main memory, rather than a disk drive as on some other machines.

The 8201 has a full-size, full-stroke keyboard with two special keys, five function keys (two programmable meanings for each), and cursor control keys laid out in a logical diamond pattern. Graphics characters are not built into the 8201 as they are on the Model 100; instead any desired graphics characters can be entered by the user with a short included utility program.

The display is 2" x 7.5" and displays eight lines of 40 characters each. The version of Microsoft Basic on the NEC has the LOCATE command not found on the Model 100, so characters as well as individual pixels (64 x 240) can be addressed. The Basic on the NEC also has on-screen editing and RENUM, both lacking in the Model 100 implementation.

In addition to Basic, the 8201 has a text editor (but no output formatter) and telecommunications software package (but no built-in modem). The 8201 also comes with a cassette tape of 16 utility and demonstration programs—a desirable extra.

The 8201 has output connectors for

Centronics parallel printer, RS-232 serial device, bar code reader, modem, and cassette recorder. The literature promises a floppy disk interface, but we have been unable to get any information on it.

For an attractive price, the NEC PC-8201 offers a great deal of capability—Basic computations, word processing, and communications, with RAM cartridges for external storage. The machine should have appeal for a wide cross section of people needing a true portable computer.

CIRCLE 474 ON READER SERVICE CARD

Teleram 3000

The Teleram 3000 was the first notebook portable introduced. It was targeted at large corporate users, and has found good acceptance in that market.

The 3000 is one of the largest notebook machines, weighing in at nine pounds. However, in this package, it has a full-size, full-stroke, completely standard keyboard; four-line by 80-character display; 128K of internal bubble memory (expandable to 256K); and CP/M operating system.

The 3000 has 64K of RAM; the one or two 128K bubble memory cartridges are accessed from CP/M like a floppy disk in drive A. The Teleram uses a CMOS version of the Z80; performance is similar to the four other machines using this configuration.

In addition to the standard alphanumeric keyboard, the 3000 has a numeric keypad to the right, eight programmable function keys with two meanings each, and several special keys.

Built into the 3000 are MBasic, several CP/M utilities, and a communications program called teleTalk. Microsoft Basic functions are as expected, although the graphics commands are not implemented; apparently the Teleram people couldn't imagine doing graphics on a 1.1" x 8.2" LCD screen—can't say as we blame them.

The teleTalk package is an especially rich communications package providing auto-dial, auto-answer, data capture, dump, and file transfer. Telephone numbers, passwords, commands, and log-on procedures may all be stored in command files. We were very impressed with the file transfer capabilities which allow all kinds of files, even CP/M .COM and text files, to be sent, received, and processed.

The Teleram 3000 has exceptional communications capabilities, a good Basic, and a standard operating system (CP/M) which opens the door to a large library of programs. Thus, the machine should have greatest appeal to the executive on the move, and the large company target audience of Teleram makes good sense.

CIRCLE 475 ON READER SERVICE CARD

Hewlett Packard HP-75C

The HP-75 is a very compact computer with unexpected speed and the highest accuracy of any computer we have ever tested—portable or desktop. It has a one-line display, but a monitor, as well as several other peripherals, are available.

At first glance, the keyboard appears to be much smaller than a standard one, but in fact is only 5% reduced. However, it uses calculator-style, short-travel keys and has a few keys in odd places; thus it is not suitable for rapid typing. A block of ten alpha keys can be specified as a numeric keypad for data entry.

Like earlier HP calculators, the HP-75 uses magnetic cards for program and data storage. Each card is 10" long and stores up to 1.4K. The cards must be pulled by hand through a slot on the lower right; it takes a bit of practice to get the hang of it, but the computer tells you if you have pulled it too fast or too slow.

The HP-75 uses a custom HP CMOS



Gavilan

processor. It comes with 8K of RAM built in. Three slots on the front accommodate additional 8K RAM cartridges or ROM software cartridges. The machine can hold several programs which are accessed like a mini timesharing system. The HP-75 even has an Appointment Mode which can trigger one of nine different alarm sounds, a Basic program, or other action.

As expected, the HP-75 uses a dialect of HP Basic which is quite different from the DEC Basic, on which Microsoft Basic was modeled. Thus, string handling, functions, and PRINT USING (DISPLAY USING on the HP-75) are quite different from what much of the world regards as standard. Nevertheless, HP Basic is quite satisfactory and has several unexpected features such as powerful TRACE utility, recursive calls, and the ability to issue operating system commands from within a Basic program.

As might be expected, HP is converting programmable calculator application packages to the HP-75. Several engineering and financial packages have been released, and more are on the way. Even *VisiCalc* is available for the HP-75; with the single 32-character display line, it is less than satisfactory, but with the optional monitor hookup, it is fine. A word processing module has been announced, but we can't imagine doing serious text entry on the HP-75 keyboard.

The HP-75 uses an interface loop structure with each peripheral device daisy-chained in a continuous loop. Available peripherals include a digital cassette drive (fast and reliable), 24-column thermal printer, video interface (16 lines x 32 characters), plotter, 80-column dot matrix printer, and several laboratory device controllers.

The HP-75 is a fine computer system, particularly for a laboratory user or someone stepping up from a programmable calculator. It is well-engineered, has a good Basic (albeit a bit

unusual), and a nice array of immediately available peripherals.

CIRCLE 476 ON READER SERVICE CARD

Gavilan

When the Gavilan was first shown at NCC in June 1983, many people wondered out loud whether it could really be made. It was just too much state-of-the-art stuff in one package for people to swallow. Now, that it is on the market and now that competitors are leaping in from all directions, the Gavilan looks more real than it did a year ago. But it still has an air of unreality.

The Gavilan is remarkably compact (11.4" square x 2.7" high) and weighs just nine pounds. Its optional, snap-on printer adds four inches and four pounds to the package. It has a 16-bit mpu, 64K of RAM, built-in 3" floppy disk, eight-line display, full keyboard, and a unique touch panel in which your finger becomes sort of an electronic mouse.

The Gavilan uses a 16-bit 8088 mpu, 48K of ROM, and 64K of RAM, expandable with up to four 32K plug-in capsules of blank memory or applications software packages. Also built in is a 3", 320K Hitachi floppy disk drive. Traffic cop chips turn off the power to the disk drive or mpu whenever it is not needed; thus the NiCad batteries provide eight hours of operation. Eighty percent of the charge can be restored in one hour on the charger.

The keyboard is a standard-size, full-stroke unit with 13 special keys to the right. Several keys are in "unusual" locations, especially the enter key next to the spacebar, but it shouldn't take too long to get used to it.

The most unusual feature of the Gavilan is the touch pad below the display. This lets you manipulate objects on the screen by pointing at them. A quick movement of your finger moves the cursor a long way while a slow movement gives you fine control. Like Ap-



Epson HX-20

ple's Lisa system, pictorial representations of objects such as file drawers, file folders, documents, and a trash basket are shown on the screen.

Although the screen is capable of displaying eight lines of 80 characters, in most cases, part of the screen will be devoted to menus in "windows" appropriate to the software package currently in use. This loss of a portion of the screen makes one wish mightily for a screen three times as large. At home base your prayers are answered, since the Gavilan provides standard video output to a monochrome monitor.

The Gavilan has a built-in 300-baud direct-connect modem supported by a comprehensive software package. It also has interfaces for the optional printer, a second disk drive, RS-232 serial device, and video output.

Besides MS-DOS, MBasic, and the communications software, Gavilan makes available an Office Pack of four applications, *Sorcim SuperCalc* and *SuperWriter*, and *PFS File and Report*.

All in all, the Gavilan offers as much or more than most desktop systems. It is a full-function computer with few trade-offs. All this comes at a price, but for the traveling professional this is a machine that is easy to learn and exceptionally user-friendly.

CIRCLE 477 ON READER SERVICE CARD

Epson HX-20

The Epson HX-20 was the first true notebook size computer introduced. Unfortunately, lack of availability prevented it from being a runaway success when it was introduced in late 1982. Now that it is widely available, it no longer has the market to itself and will have to carve out a smaller niche among a tough field of competitors.

Several reviewers have looked at the small screen size of the HX-20 and concluded that it is not competitive with the later entries sporting screens four to

eight times larger. We think that is unfair, as the HX-20 still offers a wide array of features, some of them unique in a machine this size.

The Epson is slightly thinner than the Model 100, but weighs the same 3.8 pounds. It has a full-stroke, standard size keyboard with an excellent feel. Along with the 54-key QWERTY keyboard, it has seven special keys and five function keys, each with a dual meaning. The main disadvantage is that there are only two cursor control keys; the other two directions are gotten by pressing shift with one of the two keys. Although Basic has on-screen editing, using just two keys is a pain.

The LCD screen displays four lines of 20 characters each. The display is actually a window onto a much larger virtual screen; the size can be specified by the user. Hence, it is possible to scroll in both directions. Pixel and character addressing are possible within the 32 x 120 pixel dimensions of the screen. A small speaker can produce tones over a four-octave range.

The HX-20 uses a CMOS version of the Z80 mpu. It has 32K of ROM and 16K of RAM, expandable to 32K with an external module. Mass storage is provided in the form of a built-in micro-cassette recorder. We found this to be fast and reliable. An external cassette can also be used.

The HX-20 provides I/O connectors for RS-232 serial devices, bar code reader, cassette recorder, and a 38,400-baud serial link to other devices via an interface module which has yet to be released.

On the top left of the case is a built-in printer. It uses plain paper rolls 2 1/4" wide and prints in black or purple. It is this printer that makes the small screen size tolerable as programs or text can be printed out in rough form for correction and then printed later on a full-size printer or transmitted to another machine.

The NiCad rechargeable battery on the HX-20 provides 50 hours of use, considerably more than any of the other notebook portables.

Built into ROM is a rudimentary monitor, Microsoft Basic, and *Ski-Writer*, a word processing package. Basic is a complete implementation with no obvious omissions. Up to four Basic programs can be stored simultaneously in the machine. Many more, of course, can be stored on tape.

Ski-Writer is an adequate, if not extensive, word processing package. It can operate in either insert or overstrike mode and has block copy and delete. It will search for a string, but will not search and replace automatically. Print formatting is barely adequate, as it requires

RoadRunner



that you put page breaks into the text rather than producing them automatically.

Epson has announced a wide array of plug-in ROM software packages, but we have not seen them at the retail level yet. The communications and spreadsheet packages should enhance the appeal of the machine considerably.

The HX-20 with built-in printer and optional microcassette offers a great deal of computing power at a moderate price. The long battery life between charges is a nice plus. The machine should appeal to people needing a full-feature Basic and occasional word processing. Additional software packages should help it carve out a niche with specific types of users.

CIRCLE 478 ON READER SERVICE CARD

RoadRunner

The MicroOffice RoadRunner is one of the latest entries in the notebook computer sweepstakes. Currently, it is being marketed primarily to OEMs and large-volume end users, but it may be available by mail order and in a limited number of retail computer stores.

The RoadRunner is equal in size to a large binder and weighs in at five pounds. When it is opened, it comes to life with a small beep and initial dialog on the display.

The LCD screen measures 1.3" x 9.3" and displays eight lines of 80 characters, about the size of a dot matrix printer. Graphics can be displayed on the 64 x 480 pixel screen. The display tilts, but unfortunately does not have a contrast adjustment.

The keyboard is a full-size, full-stroke unit with sculpted concave keys. Although close to a standard layout, it has several keys in unexpected locations.

Most users will probably adjust in a week or two. The cursor keys are laid out in a logical pattern, an oversight on too many notebook portables. Six special keys and eight dual-meaning function keys are found in the top row above the standard QWERTY keyboard.

The RoadRunner uses a CMOS version of the Z80 mpu and has 16K of ROM and 48K of RAM. Four memory cartridge slots are found over the keyboard for extra RAM memory and ROM software cartridges. These are addressed from the CP/M-compatible operating system as devices A through D.

I/O connectors are provided for RS-232 serial devices, a modem module, and the main bus of the computer. The modem is a 300-baud direct-connect unit with auto-dial, auto-answer, and a wake-up mode of operation. In addition, the RoadRunner has a built-in terminal mode which emulates a DEC VT100 terminal.

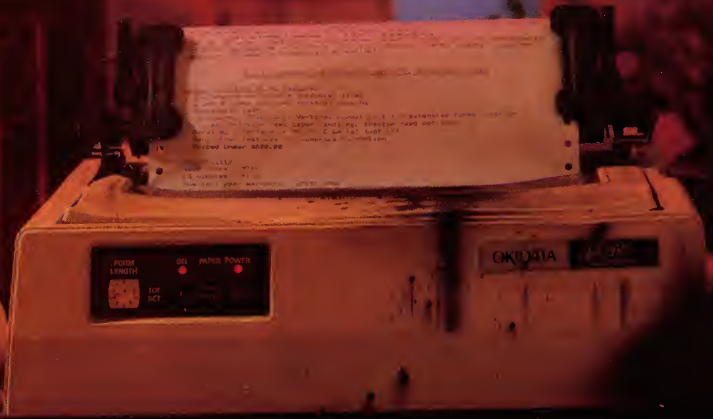
Also built in is a schedule organizer, name/address organizer, and, of course, the CP/M operating system. Available on cartridge is a full-feature word processing package with features such as character, word, and line delete, and global search-and-replace.

Cartridges are also available with Microsoft Basic (with everything but on-screen editing) and Sorcim *SuperCalc*. More packages are promised in the future.

With its excellent communications, word processing, Basic, and spreadsheet software on a machine with full keyboard, large display, and plug-in memory cartridges, the RoadRunner is sure to find a market with executives, sales people, and writers who need a portable office on the road.

CIRCLE 479 ON READER SERVICE CARD

Photo is of the actual printer rescued from Robert Brannon's fire.



WHAT A RAGING FIRE TAUGHT US ABOUT RELIABLE PERSONAL PRINTERS.

That's a printer? We've always known that Okidata makes the toughest printers, but Robert Brannon really proved it. A fire left his Microline 92 looking more like a pile of charred Silly Putty® than a printer, but being an optimist, Mr. Brannon took it to his Okidata dealer to see if anything could be salvaged.

The service department at Wolff Computers in New York City wasn't quite as optimistic, especially when they saw that the heat of the blaze had actually melted the casing and molded the plastic onto the internal workings of the printer.

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CIRCLE 113 ON READER SERVICE CARD

In the battle between the IBM PC, there can be

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A more serious way to be serious.**

The Epson is easy because its keyboard works in English, not computerese. And only

the Epson comes with *Valdocs*™, a powerful integrated software system that takes you step-by-step through the five most important business functions: word processing, business graphics, telecommunications, electronic filing and daily scheduler.

As a result, while IBM owners are still pondering their manuals, and Macintosh owners are still drawing sneakers, Epson owners are churning out productive work with electronic speed and accuracy.

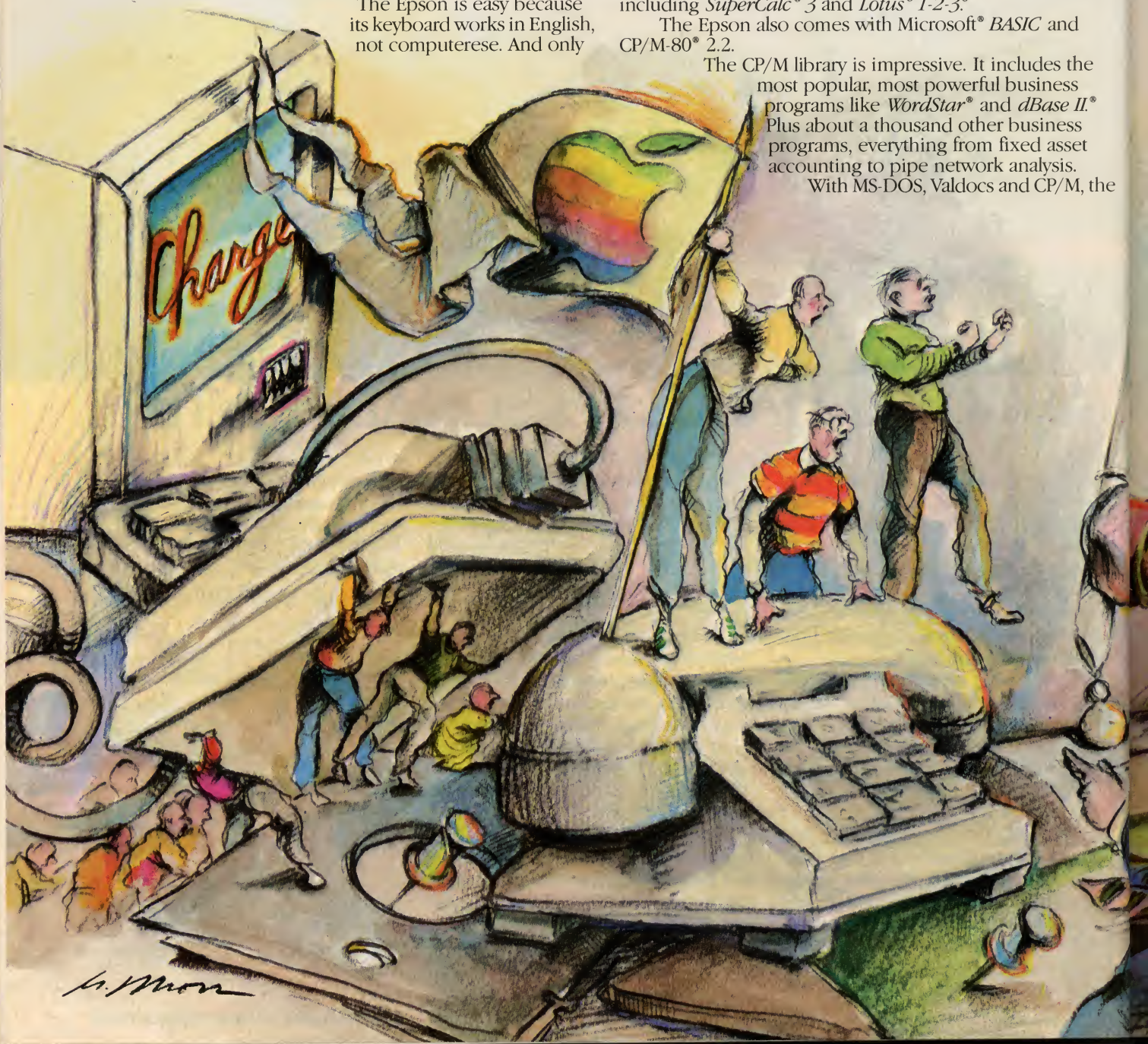
The Epson also opens the doors of your disk drives to the largest collection of software in captivity. In fact, the Epson runs *more* business programs than the IBM PC.*

To start, the Epson is available with an optional 16 bit co-processor so you can use almost any MS™-DOS program, including *SuperCalc*® 3 and *Lotus*® 1-2-3®.

The Epson also comes with Microsoft® *BASIC* and CP/M-80® 2.2.

The CP/M library is impressive. It includes the most popular, most powerful business programs like *WordStar*® and *dBase II*®. Plus about a thousand other business programs, everything from fixed asset accounting to pipe network analysis.

With MS-DOS, Valdocs and CP/M, the



...the Apple Macintosh and ...the only one winner. The Epson.

Epson should be able to handle any future business need. And that should make you feel very good about siding with Epson today.

The ultimate technical specification: value.

The Epson QX-10 comes complete with a 12" high resolution monitor, 600 x 400 Pixels, driven by one of the most powerful graphic processors available. With screen resolution this good, text and graphics will leap off the screen. And when you add a graphics program, like *Q-plotter*,™ you can produce presentation graphics of the highest order.

Standard issue on the Epson also includes 256K memory, plus 128K resident video memory, dual 380K Epson-made disk drives, a CMOS Realtime Clock/Calendar with battery backup, a 1-year warranty, an RS-232C port and a parallel port; thus freeing the five—that's right, five—



option slots for some real options.

Best of all, everything is Epson quality, the same quality that has made Epson the number one manufacturer of computer printers, worldwide. And when you consider that Epson gives you a complete computer system at a price a thousand dollars less than either Apple or IBM, you understand why this computer can not only bring peace to your desktop, but to your budget, as well.

*With optional MS-DOS board Apple, the Apple logo, IBM, Epson, SuperCalc 3, Lotus 1-2-3, CP/M-80, Microsoft, WordStar and dBase II are registered trademarks of Apple Computers, Inc., IBM, Epson Corp., Sorcim, Lotus, Digital Research, Microsoft, Micropro and Ashton-Tate respectively. Valdocs, MS-D-plotter are trademarks of Rising Star, Microsoft and Metro Software respectively.

EPSON

STATE-OF-THE-ART...SIMPLICITY.

CIRCLE 102 ON READER SERVICE CARD



Corvus Concept

Less Than a Mini, More Than a Micro

George Blank

Would you like a computer that can network with IBM PCs, Apples, and CP/M computers, sharing files on a hard disk? How about a computer that would easily allow you to develop a spreadsheet, create a three-dimensional graph from the spreadsheet, write explanatory notes on an excellent word processor, and then drop the graph and relevant section of the spreadsheet directly into the middle of the word processing text to be printed? Would it help if the screen could hold more than six times the information normally found on the screen of an IBM PC, Apple II, or TRS-80? If so, you might want to investigate the Corvus Concept.

Calling the Concept a personal computer is stretching a point. While this computer compares favorably as a stand-alone system with the Apple Lisa and the IBM PC XT, it is clearly intended to be used in a network of computers; a network that can include Apple and IBM computers as well as other Concepts.

The system is fairly large and covers a full desktop. The monitor mounts on a swivel base on top of the CPU and can be tilted to set the viewing angle. It can be mounted either horizontally or vertically; a switch on the back of the CPU sets the mode. The detached, 89-key keyboard has a coiled cord that allows use anywhere within five feet of the back of the CPU.

***I taught an artist
to access the system
and use the
graphics software
in ten minutes.***

The hard disk drive and 8" floppy drive take up the rest of the desktop, but could be mounted underneath.

This is a very complex system. It takes a long time to set up and even longer to learn to use it effectively. Although the system is provided with enough manuals

HARDWARE PROFILE

Product: Corvus Concept

Type: Small business computer with networking

CPU: 16-bit 68000

RAM: 128K or 512K

Keyboard: Detached, 89 keys

Text resolution: (switch selectable)
72 rows 91 columns vertical
or 56 rows 120 columns horizontal

Graphics: bit mapped; 458,744 pixels

Documentation: (Too?) many manuals

Price as tested: \$10,235
includes 512K system \$4995
8" Drive \$995
20Mb hard disk \$3995
ISYS Software \$495

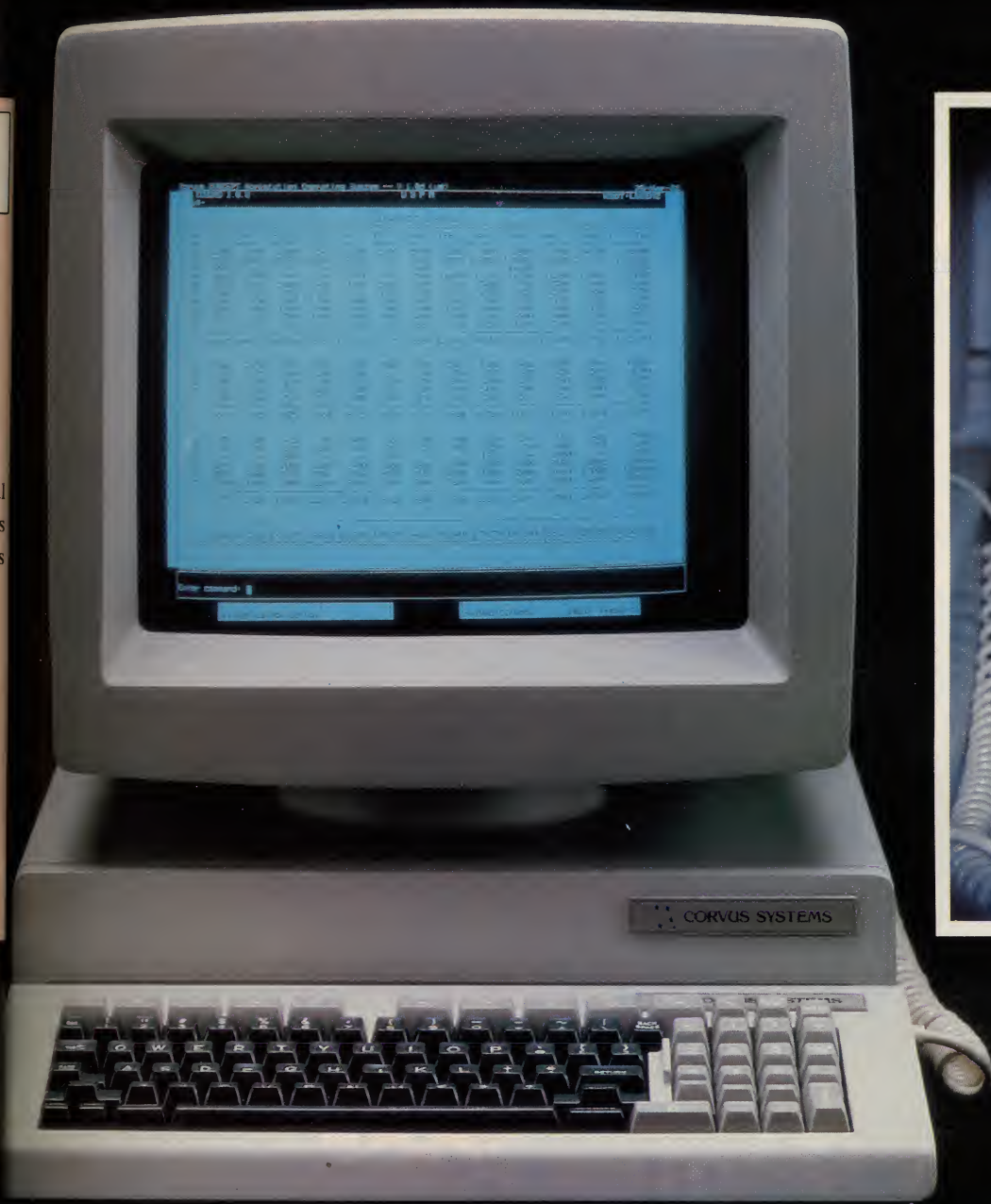
Summary: Excellent system for small networks; terribly inadequate documentation.

Manufacturer:

Corvus Systems
2100 Corvus Dr.
San Jose, CA 95124
(408) 559-7000

to stock a library, they are of mediocre quality, and most lack an index. However, Corvus does offer excellent technical support over the telephone. I had to make at least a dozen calls over a two-month period, and was never disappointed with the quality of the help I received.

During the week after Christmas, when the rest of Corvus was on vacation, the telephone support staff was on duty. When I asked a question during that period that no one on duty could answer, they called me back a few hours later with the answer. By waiting until after 5:00 p.m. to call and using Sprint, I kept the total cost of the phone calls to \$35—probably reasonable for a \$10,000 computer system. (I have had extensive experience with many different computer systems, however, and someone with less experience would prob-



ably have more questions and more difficulty.)

Setting Up the System

After unpacking the system, I spent half an hour browsing through the various manuals trying to figure out what to do first. (Corvus does not provide a Read This First instruction sheet, but they desperately need one.) Finally, I just picked one of the installation guides at random and started with it. By working my way step by step through the Personal Workstation Installation Guide, the Diskette Drive Installation Guide, and the Disk Drive Installation Guide, I managed to get the system set up, but not working. When I could not get past part of the hard drive set up, I called Corvus. They quickly diagnosed my problem as a need

to reformat the hard disk drive and talked me through the procedure.

After setting up the system, it is necessary to install the software. This is also a complex process, taking several hours and involving step-by-step instructions in a separate manual for each package. In general, the process involves setting up an area on the hard disk to hold each application, possibly setting up another area of storage for files generated by that application, copying the software to the application area, then deciding which users of the system will have access to each application and setting up the access tables to allow them to do so.

Many of the other tasks involved in using the system are equally complex. This does not mean that the system does not support casual users. I taught an artist

to access the system and use the graphics software in ten minutes, and he had not previously operated a computer. But at least one skilled computer operator should be available at each installation to serve as the system manager and handle special problems. Even such a simple operation as copying a file from the hard drive to a floppy disk can involve 15 minutes of searching through manuals and ten or more programming steps.

To use the system, as a casual user you would type your user name, then enter your password. This would bring you to the "dispatcher level" of the operating system. Labels at the bottom of the screen would reference the ten function keys at the top of the keyboard. Probably, you would first press function key 4, labeled SetVol, and type the name of the volume



New Qantex 7065. A fast printer at a slow price.

No matter how heavy the traffic, our new Qantex 7065 multimode printer will keep your documents flowing smoothly. At a very affordable price.

Use it for data processing, and the 7065 zips along at 300 cps bidirectionally. Both user-defined formats and six-part forms capability are standard.

Switch to word processing and the 7065 delivers near letter quality at 125 cps. Plus features such as proportional spacing, justification, auto-underline and bold.

And as a 65 cps letter quality

printer, it's fast enough and quiet enough to leave the competition in the dust. You get high density, double pass printing in your choice of some 20 fonts.

The 7065 is also a dot addressable graphics printer with resolution to 144 x 144 dots per inch and a full complement of line drawing graphics.

Besides being very fast, the 7065 is very compatible — with IBM, Apple, Lotus 1-2-3 and just about any other personal computer or software on the market. It offers built-in bar code capability. And its 500-million-plus char-

acter print head and industrial quality construction are designed for long, hard use.

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CIRCLE 117 ON READER SERVICE CARD

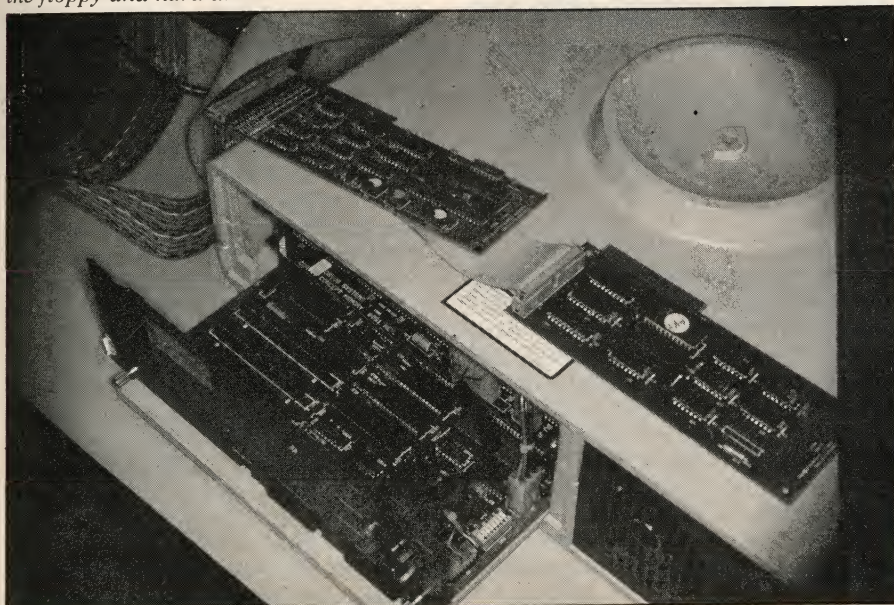


20Mb of disk storage for \$3995.

Warmware rather than hardware or software is becoming the major cost in a computer system.

The back panel includes a network port, two serial ports, keyboard and monitor ports, monitor vertical/horizontal switch, power connector and power switch.

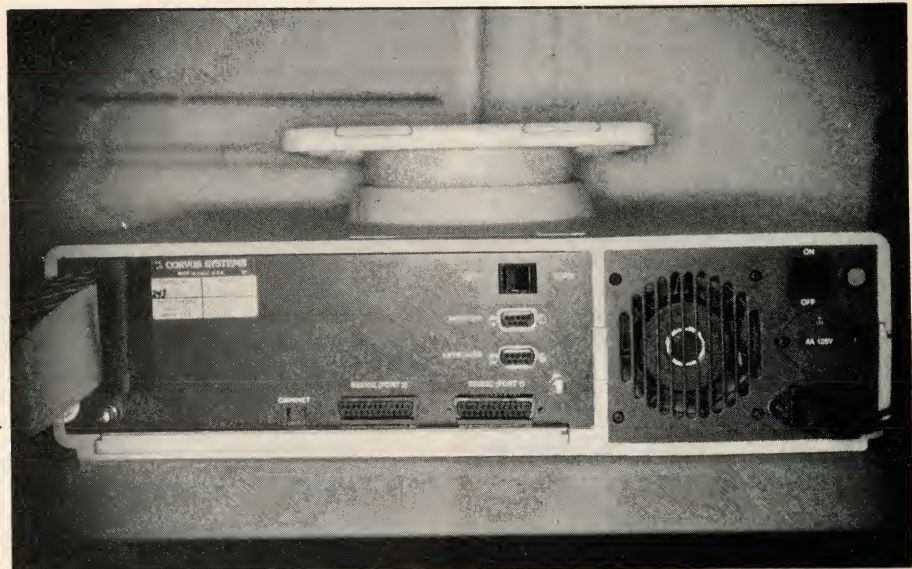
A pull out tray has four Apple-type expansion slots. Cards shown here are for the floppy and hard drives.



(hard disk memory storage area) within which you wanted to work. Next you would press the function key appropriate to your application. For example, on my system, function key 1 is the UCSD Pascal programming environment, key 2 is the Logicalc spreadsheet program, key 3 is the ISYS system described later, and shifted function key 3 enters the Edword word processor. Depending on which key is pressed, the appropriate software would load into memory from the hard disk, initialize, and begin to accept your input.

ISYS Integrated Software System

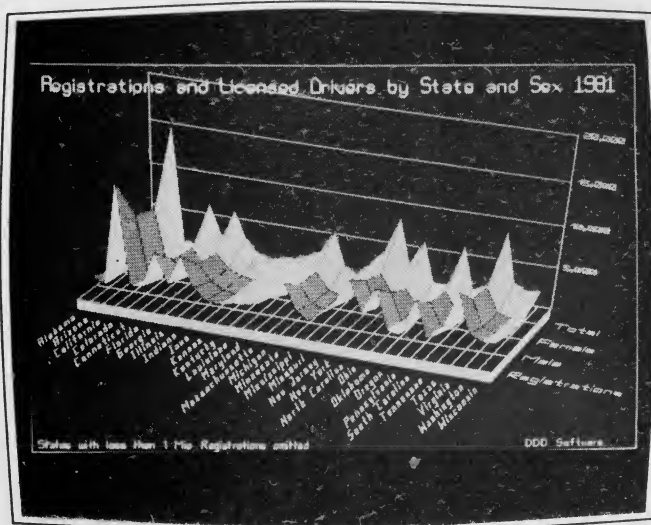
It is necessary for me to stress that I am speaking as a beginner in evaluating the ISYS software. It typically requires at least 60 hours of use to become proficient using any typical business software application, such as a word processing program. ISYS includes several such applications, plus operating environments that are as complex



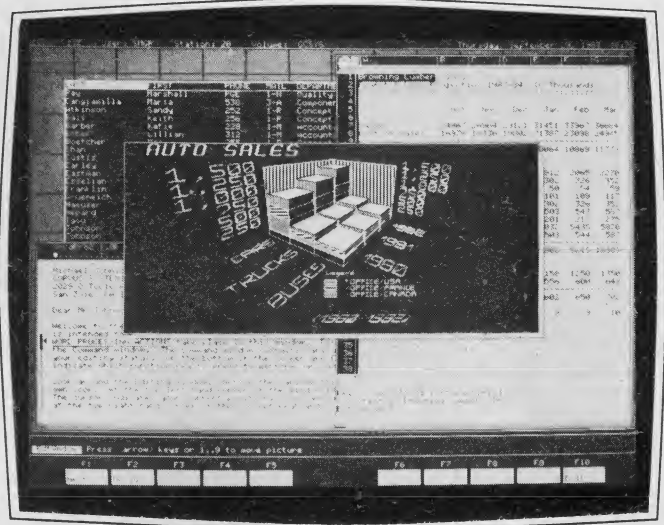
as the applications.

I have used Edword for only about eight hours, Logicalc about 30 hours, and Graph about 20 hours, so I cannot claim to be an expert on any of them. I spent only a brief time looking at the data communications, list management, and file sorting functions of ISYS. The desk tool functions were moderately useful and very easy to learn.

Using the 60-hour average, which seems appropriate from my experience with the system so far, I estimate that it would take 12 weeks of full time use to become a fully qualified system manager of a Concept workstation running the ISYS software, and another four weeks if the system were networking with other computers. This is largely a function of the complexity of the system; if it did a lot less, it would be a lot easier to learn and use. But it does indicate that warmware (a human being, probably collecting a



ISYS Graph creates impressive three-dimensional graphs.



ISYS integrates Graph, Logical, List Management, and Edword.

good salary) is becoming the major cost in a computer system rather than hardware or software.

The ISYS system environment is menu driven. It works through ten function keys, which (unlike those on the IBM PC) are properly placed along the top row of the keyboard. The bottom three rows of the display typically contain ten inverse-video blocks—one for each function key—with up to two labels for each key and the label F1 through F10 above each block.

Each function key can have four meanings at any single menu level: the regular function, another with the shift key, a function when the command key is also pressed, and a function with both the Shift and Command keys. Pressing the command key by itself displays a second set of function key labels. Above the function keys will usually be a box containing two more lines to receive command input and display messages from the application or system environment. Because the screen is so large, dedicating five lines at the bottom to command and control functions does not appreciably reduce the work space available.

The top of the screen contains a status line, displaying the current operating system, user name, station number, disk volume name, day of the week, date, and time. To set the command areas apart from the work area, the work area is enclosed in a box made from four narrow lines.

The well-labeled function keys make the Corvus Concept, at one and the same time, one of the easiest and one of the most difficult systems I have ever used. If the function I need is displayed on the screen, it is easy to find and use. This is true in most of the applications for most of the commonly used functions. If I have to press the Command key to find the

function, I am not quite as satisfied. If I have pressed a function key to go into another menu and then find the function I need, I become exasperated.

Sometimes you have to go through several pages of menus to get to a function, and it is easy to get lost on the way. But worst of all, for many functions in the Corvus, you have to search through several manuals that don't have indexes to find the instructions. Then you have to page through several menus to accomplish preliminary functions. Then you must type

Altogether, the program has more than 140 functions, and it is fully integrated with the data communications, spreadsheet, and business graphics in ISYS.

relatively meaningless or illogically abbreviated commands without error after accomplishing all of the necessary preliminaries. This is far too much effort to complete what should be a simple task! In general, however, the functions are well thought out. For example, function key 10 is usually dedicated to exiting from the current menu. If this is likely to cause trouble if done at the wrong time, then the shifted F10 key may be required to exit.

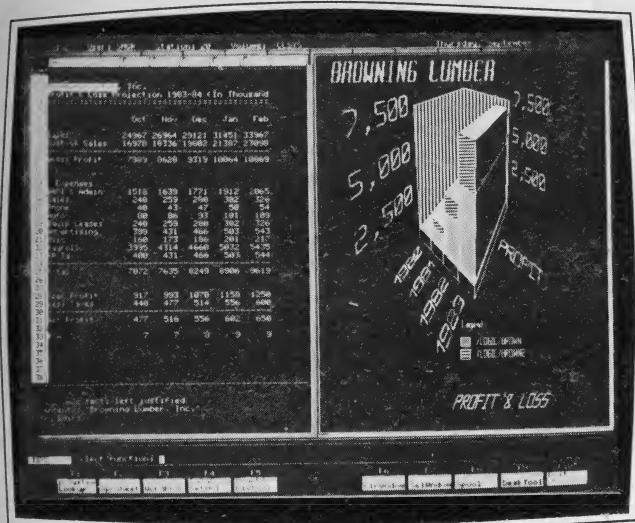
Word Processor

I like the Edword word processor better than any of the more than 20 word processing programs I have used in the past six years. Although it would probably take many hours to become an expert with the system, it takes only a few minutes for a beginner to learn to accomplish most ordinary word processing tasks.

After I created my first sample workspace, without even looking at the Edword manual, a letter from Corvus Systems appeared in the workspace automatically. The letter, which would fill about three single-spaced typewritten pages, was actually an interactive tutorial on Edword. It taught me how to use the function keys, enter and delete text, mark sections of text, cut and paste, and use the undo function. I love having function keys for both undo and redo.

It is a joy to be able to display 72 rows of text on the screen at one time, with 90 characters in each row. At the top of the screen is a ruler with the tab positions indicated for laying out your text. Also listed are the program name, version number, and the name of your file. The screen functions as a moving window, so the document can be wider and much longer than that which could be accommodated on a single screen. On the left edge of the screen is a line which has a thick portion to show the vertical position of the current window in the document and an arrow pointing to the line that holds the cursor.

At the bottom of the screen you find a long open box with the current horizontal position in the workpad shaded solid, the number of the current line, the number of lines in the document, and the column number of the current cursor position. The line below that holds the mode (i.e. Edit) in inverse video, plus any status messages from the program to the user.



Split screen displays graph made from spreadsheet data.



List, letter, and calculator on one screen.

The function key labels indicate 20 functions on the regular menu, with 12 more on the command menu. Some of the functions invoke a new menu. For example, the Format key displays a new menu with 16 functions, including headers, footers, line spacing, justification, margins, headlines, page breaks, centering, and comments. Altogether, the program has more than 140 functions, and it is fully integrated with the data communications, spreadsheet, and business graphics in ISYS. Edword is included in the price of the Concept, and for some people, may justify the purchase of the computer.

Spreadsheet

The Corvus spreadsheet program, Logicalc, is a powerful application. It is the fourth spreadsheet program I have used seriously. I prefer Logicalc to Microsoft's *Multiplan* and to *VisiCalc*, but, given a choice, I would do my own work on the IBM PC using *Perfect Calc*. The biggest advantage of Logicalc is the increased screen size of the Concept.

I was able to display 12 months of 18 different accounts for my business on the screen at one time, with summaries, titles, and extra lines and blank space on the screen to increase readability. The function keys make the system easy to use in most cases, and I found all the functions that I have come to require in a spreadsheet, including titles displayed over more than one cell, independent column widths, and the ability to lock areas of the spreadsheet.

What I liked least about Logicalc was the inability to exit a newly entered cell with the arrow keys. You must press Enter or Return (the Concept has both keys, with no functional difference!) to exit a cell. If the Advance key is on, this will automatically move you one cell to the

right. If you don't want to go right, you must use the arrow keys after pressing Return. I much prefer to eliminate a keystroke and exit the cell with an arrow key.

The lack of an index or the manual or a reference card for Logicalc is a very serious drawback to this system. I had so much trouble searching for information in the manual that I finally gave up and went back to *Perfect Calc*. I found that I was happy to trade a large screen display for ease of use.

ISYS Graph is a fascinating high-resolution business graphics program.

Logicalc can be entered directly from the opening menu of the Concept, called the Dispatcher Level, or through the ISYS menu. If you enter directly, your spreadsheet defaults to 40 rows of 11 columns of 10 characters. From ISYS, only 34 rows of 10 columns of 10 characters are displayed. However, several features are added under ISYS, including an Undo command; table lookup; selective column display; direct line charts, bar charts, or dot graphs (in addition to the ISYS Graph program); and program suspension while another ISYS function is used. Additional functions include a forms mode, user defined functions, and built-in functions for internal rate of return and net present value.

Graph

ISYS Graph is a fascinating high-resolution business graphics program. There are 83 built-in templates for pie charts, bar, line, surface, ribbon, outline, and freeform graphs, and you can modify any of the templates or create your own. It will read several forms of files, including Logicalc files and Edword files, and draw charts from the data.

You can select a three-dimensional graphics template and press a single function key to draw a chart automatically from your data file. You can also use a zoom lens function to set the graph to the size you want, rotate it around the X, Y, or Z axis for the best viewing angle; choose three different shadings for the base and two displayable reference planes; choose a border for the base; choose a text font, printing angle and size for the labels; and move the whole graph to the desired location on the screen, redraw it, save it, move over into Edword, and drop the graph right into the middle of your text.

The system is very powerful and easy to learn and use, but it is limited to producing graphs from data files. If you wanted to use the high-resolution graphics on the Concept for other purposes, Corvus offers another program (not tested) called Corvus Paint, which has 200 commands and uses a mouse, for \$395.

ISYS Desk Tool

The ISYS desk tool includes a perpetual calendar that will display any month of any year, and an international clock which shows the time in all world time zones, with one city referenced in each. Also included are a high-resolution analog clock with moving hands, a stop watch with lap timer, and a calculator that includes trig and log functions and which displays a

moving tape. I haven't figured out a use for the lap timer yet. Perhaps I could look out the window and clock cars on the highway?

List Management

The ISYS List Management program allows you to create files that are collections of records, such as a mailing list made up of multiple fields for title, first name, last name, street address, city, state, zip code, and information fields. Once a template is created for the necessary records, the program can input data, edit, search, and sort a list.

The ISYS Lookup program will search files up to 100,000 characters long. You can selectively search any data field in the list and display it to the screen or save it to a file. You can also use the List program to create a form to merge a list with Edward files for printing form letters or addressing envelopes. Unfortunately, merged fields have fixed lengths, so if you allow 25 characters each for first and last names, Sam Smith will receive a form letter with 22 spaces between his first and last name.

Data Communications

The ISYS Data Communications program is a complete serial communications program. The function keys and menus make it extremely easy to use, and the screen display is one of the most helpful I have ever seen in a communications program. Most of my own file transfer in-house uses the XModem (Christiansen) protocol, which allows automatic file transfer with error checking, so I was happy that this was supported on the Concept.

The program will emulate a VT100 terminal for communication with mainframe computers. The instructions for hooking up to another computer are much better than I have seen with other terminal packages. They include information on pin connections for creating a null modem and settings for the Hayes Smartmodem.

The automatic dialer allows you to maintain a directory containing name, phone number, logon sequence, password sequence, baud rate, word length, and parity for systems you use. The only feature I like in a communications program that is missing is the ability to program individually the output lines and read the input lines (CTS, DSR, etc.), so that I can analyze handshake problems.

Overall Impressions

With the exception of the need to reformat the hard disk drive before setting up the computer, I did not experience any hardware problems in three months of regular but intermittent use. I encountered several software problems, none serious. The most embarrassing one (for Corvus) was that the Set Year function in

the system clock absolutely refused to accept 1984 and insisted that it was still 1983. When I tried to use a template in the ISYS Graph program with more than the number of columns and rows recommended for that template, the system locked up and I had to turn it off to regain control. When I blew a circuit breaker by plugging an electric heater into the same circuit as the computer, the system locked me out of the application I was in, telling me it was already in use. Corvus telephone support directed me to the section of the manual that told me how to reset the semaphore table, which prevents two users from accessing a file at the same time, and everything worked fine again.

Although Corvus sent me a CP/M emulator, I was never successful in installing it on the system, probably due to a defective diskette. I lost interest when I found out that it emulated only 8080 instructions, since most of my software contains Z80 specific instructions.

The program will emulate a VT100 terminal for communication with mainframe computers.

On the positive side, I loved the large screen, the excellent, well laid out 89 key keyboard, and the use of the function keys in different applications. I didn't have a printer that could handle it, or I would have really gone overboard with the integrated word processing, graphics, and spreadsheet. Edward seems far better than any other word processor I have used.

Because I couldn't hook up my TRS-80s, my PCjr, or my Seequa Chameleon, and I seldom use my Apple II, the networking did not appeal to me. I hated the operating system, particularly all the extra work that is, unfortunately, necessary to achieve controlled access multi-user systems.

I also hated the manuals. I think the best way to judge any complicated product is to pick up the instruction manual and look through the index. If it doesn't have an index, you may have a serious problem if you buy the product. Of the 15 Corvus manuals that I received with the system, only three had indexes. The Digital Research manual for CP/M and the four Softech Manuals for the UCSD P-System did have indexes.

Despite the 68000 microprocessor, I was not impressed with the speed of the system. I started to run benchmarks, but considered

it unfair when I reflected on the increased time required to rewrite the oversize display and the extra overhead required for multiple user access control. I did find the system speed adequate, however, and significantly better than the Apple Lisa, which seemed to spend 20 minutes of each hour displaying an hourglass and the words "Lisa is preparing this window's display."

Using the UCSD Pascal operating system, I did not find any appreciable differences in speed among the Concept, my Seequa Chameleon, and my Apple II Plus. I did not run any number crunching benchmark tests because this system seems unsuited to number crunching applications; the supplied applications are oriented to business, not science, and the UCSD P-System has pathetic accuracy. Using a Pascal adaptation of Dave Ahl's benchmark test—computing 100 square roots, squaring them, and adding the sum of the differences—I received perfect accuracy (.00000000000000) on the Seequa Chameleon with Turbo Pascal, accuracy in the top 5% of the systems tested by *Creative Computing* on the TRS-80 with Pascal 80, and by far the worst accuracy of any of the systems tested on the Corvus using UCSD Pascal. Since Corvus does not currently supply a Basic interpreter, (a Basic compiler is available from Softech Microsystems for \$395) and UCSD Pascal (unlike the other Pascals mentioned) lacks random number functions, the actual benchmark could not be run.

Additional Software

Since this computer is obviously aimed at small business users, it is critical to know what other software packages are available. Applied Software Technology offers *Versaform* for the Corvus at \$495. This is a powerful and reasonably flexible business forms processor with some database functions. I have been using *Versaform* for two years on the Apple to maintain my company mailing lists.

A.D.I. America offers the *Aladin Plus* relational database manager for \$795. *Aladin Plus* allows a million records per file, unlimited key fields, and access to non-keyed information, with special features including summation, protected and comment fields.

Accounting packages are available from Great Plains Software (\$500 to \$2600), Molten Lava Software (\$500 to \$2800), and Microfinancial Corp. (\$900 to \$11,150). Abacus Data supplies five different database management systems for \$399 to \$1195, including *Informax-20*, a multi-user DBMS. Some of the many packages offered by other suppliers include medical office management, electronic mail, PERT charting, mailing list management, legal client record keeping and billing, statistics, manufacturing analysis, and educational administration software.

Pricing

The Concept workstation, as tested, included 512K of memory, 20Mb of hard disk storage, an 8" floppy disk drive, and a monitor which can be mounted vertically to display 72 rows and 91 columns, or horizontally to display 56 rows and 120 columns of text.

List prices for the system are \$4295 for a 256K Concept workstation, with monitor and detached keyboard, and \$4995 for the 512K workstation. The floppy disk drive is \$995 additional, and hard drives range from a 6Mb drive for \$2195 to a 20Mb drive for \$3995. The operating system and Edword word processor are included in the price. The ISYS integrated spreadsheet, graphing, word processing, and communication software costs \$495. If you are networking the system, the necessary cards, cables, and tap boxes cost \$495 per workstation (Concept, IBM, or Apple), or \$1895 for a four-system Omninet Transporter Package. Separate versions of the 512K Concept workstation that run Unix cost \$4295 for the Concept Uniplex that can be expanded to two users and \$5995 for the Concept Plus that can service eight users. The Unix versions of the Concept cannot run non-Unix software.

The Corvus Network system would be a good choice for lawyers, doctors, retailers, wholesalers, real estate brokers, small manufacturers, and other small businesses with a need for three to eight workstations—businesses too large for a single microcomputer, but too small to justify a minicomputer system.

CIRCLE 486 ON READER SERVICE CARD



How to use computers to

COMPUTERS IN MATHEMATICS:

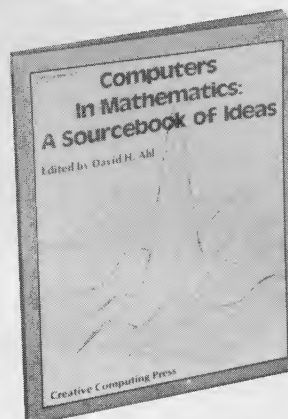
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The Limits of *Lisa*

Because a discussion of the limits of something often comes across as criticism or as a negative review, let me state up front that I am unequivocally impressed with the Lisa. I could not fail to notice the incredible detail that went

R. Skip Horvath

into the hardware and software design of the machine. It does what Apple says it

can do, and it does so in a relatively bug-free way. The Lisa is a joy to work with, and I can honestly recommend it to anyone in an office who needs a broad selection of standard computer programs that work well together. These are the last



unqualified words of praise you will read in this article.

Integration

Let us begin with what the Lisa is and is not. By now, everybody knows that the Lisa is a microcomputer with integrated software. Unfortunately, the term "integrated software" is sufficiently vague as to cause confusion among potential microcomputer purchasers. There are five levels of integration. Level 0 is no integration at all—the files produced by one program cannot be read by another. Level 1 is compatibility—files produced by one program can be read by another program. Level 2 is similarity of structure—not only are files produced by different programs compatible, but the methods used to manipulate the data and run the programs are highly similar. Level 3 is co-residency—the various programs not only share a similar structure, but are all resident in memory (RAM) at the same time. Level 4 is pipelining—a change made to the data in one program is automatically updated to other related files used by other programs.

Lisa is integrated at Level 2. What makes the Lisa different from a simple collection of related programs—*VisiCalc*, *VisiPlot*, *VisiTrend*, *VisiFile*, for example—is that the hardware and software were designed together. Once a user has learned how to use one of the application packages, he knows a good

deal about how to use all of them.

With integrated software, one never needs to save data, load in a new program, run the program, and read back the data. Instead, one selects the relevant data, "calls" for the new program, and plops the data in place. Thus the Lisa can be said to be integrated at a high Level 2.

Note that the Lisa software is not directly comparable to the *Lotus 1-2-3* program for the IBM Personal Computer. *1-2-3* does not call up another program, but rather keeps all three application packages residing in memory at the same time and is therefore integrated at Level 3. It is much faster than the Lisa in part because access to disk is not necessary. Its disadvantage is that it is nowhere near as complete or as flexible as the Lisa software. No Level 4 integration (pipelining) exists today on a microcomputer.

The Hardware

Many points I am making here are attributable as much or more to the software as to the hardware. My object, however, to present the practical limits of the machine as seen by the user, who does not care what the reason for a feature is, but rather how that limit manifests itself.

The mouse performs well on the Lisa.

The 11" monitor screen features black letters on a white background. While I was perfectly comfortable with this use of contrast, one of my co-workers expressed a preference for white on black in *LisaCalc*—an option not offered. The brightness levels offered are varied enough to satisfy everyone in the office. The antiglare screen seems to do the job as no one has complained about glare.

The keyboard arrangement holds no surprises for IBM Selectric users. Although there are a few extra keys, they are not placed in awkward places or between keys that are normally next to each other. The keyboard does have a bouncy feel as though one were typing on springs; even the sound is slightly springy.

There are many international symbols available as an alternate character set on the Lisa, but no provision for the Greek alphabet used heavily in mathematical, engineering, and scientific applications, and no double underlining key for accounting work. The keypad on the right of the keyboard lacks a raised dot on the 5 to help fingers find home; the keypad is otherwise standard.

Apple dot matrix print sample (12 pitch modern), demonstrating quick draft output -- either normal or high resolution

Apple dot matrix print sample (12 pitch modern), demonstrating finished quality output with normal resolution

Apple dot matrix print sample (12 pitch modern), demonstrating finished quality output with high resolution

Figure 1. Print samples from Apple Imagewriter

The mouse performs well on the Lisa. The design is simple: a small, dense rubber ball sits in a well that pushes a spring against it to apply pressure on two rolling contacts that move in x-y coordinates. In fact, the design is so elegant that a co-worker was disillusioned when I explained the mechanism; she preferred to think that some electromagnetic force translated the movements of the mouse to the screen. The ball is easily removed and cleaned with warm water when Coke or sandwich crumbs (mouse droppings?) gum it up. The electronics are isolated from the ball, so they are not affected by foreign matter, a problem that plagued earlier mouse designs.

Printers

To obtain our hardcopy we use Apple dot matrix printers. As with most dot matrix printers on the market, these appear quite reliable and well-designed. The speed of the printer is disappointing, however. There are three levels of print quality—normal/text, normal/finished, and high/finished. Table 1 shows the speeds of the various print qualities.

Speeds of the Apple Dot Matrix Printer

Normal/text	29 cps
Normal/finished	12 cps
High/finished	6 cps

Table 1.

HARDWARE PROFILE

Name: Lisa 2

Type: Small business computer

CPU: MC68000, 32-bit

RAM: 512K, expandable to 1Mb

Keyboard: 77 keys, detached, mouse

Display: 132 characters by 40 lines, 720 x 364 pixels, black and white

Disk Drives: 400K 3½" microfloppy; also available: 5Mb and 10Mb hard disks

Ports: Two serial, one parallel

Operating System: Proprietary

Documentation: Seven 9 x 10" loose-leaf binders, owner's guide

Summary: Sets new standards for the phrase "easy to use."

Price: \$3495; with 5Mb hard disk, \$4495; with 10Mb hard disk, \$5495

Manufacturer:

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Cupertino, CA 95014
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These speeds are quite low and could easily be confused with daisywheel printer speeds. Part of the problem seems to be that the printer does not always use logic seeking which means that it wastes a great deal of motion in moving the printhead from line to line, as it does when it goes from the righthand end of one line to the lefthand end of the next instead of starting at the righthand end and printing backwards. Also, much of the slowness seems attributable to an inordinate delay between lines. This delay increases with the quality of the print.

One has the option of continuing to work on the Lisa while a document is being printed (one can even work on that same document). Unfortunately, that option slows down the printing even more than the above table shows. Another flaw is that one may not queue up printing jobs, but must wait until one is finished before the next can be ordered.

Like every other spreadsheet I have used, the number of rows and columns in LisaCalc far exceeds the practical memory limitations.

Disk Drives

One microfloppy disk can hold 400K of data. As expected, the speed with which Lisa accesses the floppies is noticeably slower than that of the Profile hard disk, but faster than, say, the Apple II disk drives.

The 5Mb Profile hard disk has performed well. I have experienced no hardware problems with either of the

two I bought. The disk platter itself is non-removable and is 5¹/₄" in diameter. The average access time is 95 milliseconds, which is slower than most of the hard drives now on the market. The reason for the slower speed is simply that the Profile, like the rest of the Lisa hardware, represents a conservative design approach. No risks were taken with the hardware because the highly innovative software was difficult enough.

LisaCalc

LisaCalc is a big improvement over *VisiCalc* but falls a little short of *Multiplan* in power. For those used to the standard version of *VisiCalc*, perhaps the most useful added features are individual column width control, page markers to make formatting easy, centering, extensive formatting of numbers, use of dates as data, and the search function. (The search function permits a user to loop through a column or a row

LisaMyths

The Lisa is too expensive for what you get. Not true. The Lisa 2/5 is available with a 5Mb hard disk, one 400K microfloppy monitor and keyboard, and six integrated software packages. A Fortune 32:16 with 1Mb of RAM and a 5 Mb hard disk retails for \$13,000. And that does not include any software. (The multi-user capability of the Fortune 32:16 is a definite advantage, but is not relevant here where we must compare, if you'll excuse the expression, apples with apples.) It is true you can load up an IBM XT PC or a similar 8086/8088 machine with an extra floppy disk, a half megabyte of RAM, and software for about \$8000, but then you sacrifice expandability. The Lisa comes standard with almost twice as much memory, 1Mb of RAM, as the maximum that the IBM PC can be expanded to—640K. Speed of execution is also a factor: the Motorola 68000 microprocessor is superior to either the 8086 or 8088. (Note, however, that poorly written software can make any processor slow.)

The lack of color is a step backwards. Not really. Think for a moment about the intended market for the Lisa—medium to large businesses. Color is only useful for graphics. When people first see the wonderful bar graphs and pie charts appearing in splashes of high-resolution color on the screen, they react with oohs and aahs, not unlike a crowd at a fireworks display. But using the

color graphics requires a printer or a plotter capable of transferring the graphs, in color, to paper or transparencies.

A color photocopier is then needed to reproduce the colored graphs for internal or external distribution. Most businesses, even large ones, do not photocopy in color on paper because the oohs and aahs elicited from viewers of colored graphs are not worth the expense of the equipment. While colored transparencies are easily made with plotters and do not usually need to be reproduced in quantity, use of them does not justify the price of a good plotter unless briefings are frequent and elaborate, and most businesses do not bother. The Lisa, aimed at business, does not need color.

The application packages, especially the word processor, LisaWrite, are slow. Partially true. It is not possible to perform extensive objective benchmarks with the same programs written for other machines, because for the most part such programs do not exist. But we can come close by comparing *VisiCalc* with *LisaCalc*. I constructed a model on *VisiCalc* that used up all of the RAM of my 64K Apple II+, then retyped that model into *LisaCalc*. The model loaded in 2 minutes and 10 seconds on the Apple II, and in 55 seconds on the Lisa. That improvement is due to Lisa's faster hard disk. But recalculation of the model required 26 seconds for both ma-

chines. That statistic is surprising and is probably due to efficient programming in *VisiCalc*. Regardless of the reason, I am disappointed to find such slow performance from such a powerful microprocessor as the 68000, and can only blame the software.

LisaWrite is also slow, and a good typist can not only get ahead of the screen, but of the type-ahead buffer if the printer also happens to be in use. It also seems to require more time than is necessary to scroll from one page to the next. (My Apple II puts up a screen of text in a blink of the eye. The Lisa seems to pause before scrolling and then fills in a screen one line at a time.)

Part of the reason is that *LisaWrite* writes to a bit-mapped screen as opposed to a character-generated screen. Most microcomputers use character-generated screens for everything but graphics, for which they use bit-mapped screens (on which each pixel can be addressed individually). Use of bit-mapped screens for all the Lisa application programs facilitates the integration of those programs. A buffer guarantees that the screen will not drop any characters, but the sluggishness is unquestionably annoying, especially if one composes at the terminal. Apple is reportedly working on speeding up key aspects of all the Lisa software packages.

There are better application programs on the market than on the Lisa. True for all but *LisaDraw*. If one needs only a database management system, for example, there are on the market at least four or five programs superior to *LisaList* that will run on less expensive machines.

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to test for a condition, operate on the outcome, and store a running result.)

LisaCalc permits circular references. For example, cell A1 can refer to cell

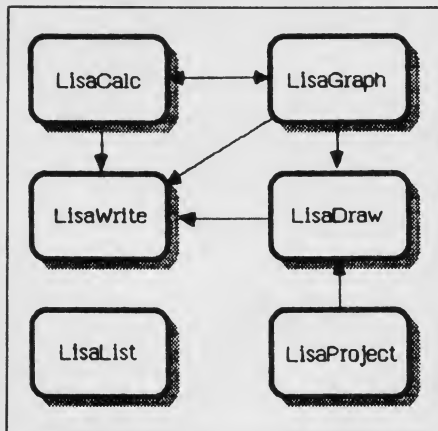
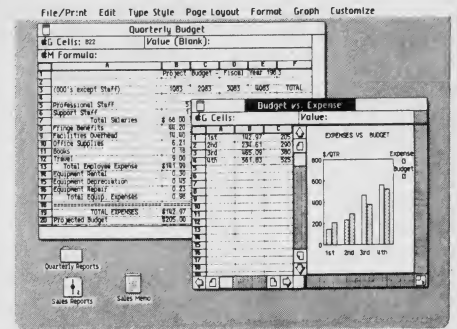


Figure 2. The arrows show the direction in which files can be transferred between Lisa application packages

A2, which in turn refers to cell A1. This feature is criticized by some (*Multiplan* does not permit it), but I have found it quite handy. Like every other spreadsheet I have used, the number of rows and columns in LisaCalc far exceeds the practical memory limitations. Even with 1Mb of RAM, the Lisa permits disappointingly small spreadsheets. I was able to place a four-digit number into each cell (more than 65,000 numbers) without a problem, but when I tried to define each cell so that it took on the value of the previous cell plus one (so that cell F208 was defined as F207+1), I ran into the memory constraint on the twenty-fourth row; Lisa would not permit me to make the spreadsheet any larger than 23 rows by 255 columns, each with a simple formula.

The three biggest problems are the slow speed, the restriction to 75 characters per formula, and the inability to consolidate many spreadsheets into one.



Some of the major annoyances are the lack of a sorting function, the inability to align decimals in the center of the column, and the hassle of having to type long headings by filling up adjacent cells.

LisaGraph

This graphing package is a strange combination of ingenious innovation and glaring mistakes. The innovation is that

Remember that what a purchaser of the Lisa is buying is integration—the ability to cross from one application program to another. To achieve integration, the programmers had to make compromises that resulted in less than state-of-the-art programming. But such a defense is a two-edged sword, for the Lisa can be faulted not on the lesser sophistication of the individual packages, but rather on the totality of the integration.

The mouse is ill-equipped as an input device. Personal preference may play a pivotal role. Consider as an analogy the controversy on other microcomputers surrounding a separate row of function keys versus control characters for in-putting special commands such as italics into a word processor. Some people prefer not to have to look at the keyboard for a seldom-used special function key located in an out-of-the-way place. Others find it impossible to memorize dozens of control characters. No one is right or wrong here, and the same is true for the mouse. The mouse is clearly the best device for LisaDraw, but is arguably good or bad for the other applications, depending on one's personal preferences.

The question of the best input device is just beginning to heat up, and until further experience resolves the issue, a potential Lisa purchaser is advised to try a hands-on demonstration. Apple makes a good case of the mouse with the Lisa, but can be faulted for a lack of redundancy; with few exceptions, there is no alternative to the mouse for cursor movement, especially in LisaWrite. For example, if you notice a typo one line above your current position, you must

move your hand to the mouse to correct the error, and then move the mouse again to come back. A control character might be better suited for this task, and should have been provided as an alternative. To its credit, Apple put cursor arrows on the key pad for movement on the spreadsheet, and the database system rather than forcing the user to use the mouse.

Icons are unattractive to experienced computer users and offensively condescending to executives. Wrong on both counts. Why should an experienced user not appreciate a machine that makes his job easier? Unless he intends to impress co-workers with cabalistic wizardry or to demonstrate that he is indispensable because only he understands the magic of the machine, he, too, prefers pointing to a program name rather



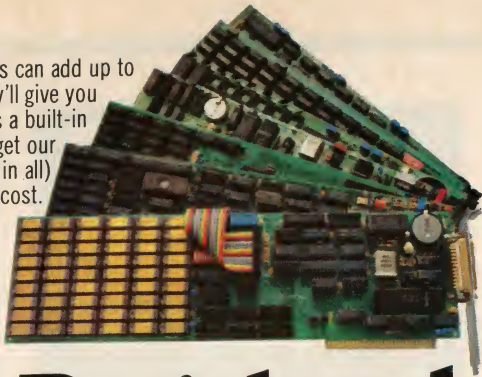
than being forced to spell it out along with arcane instructions to execute the program. Note that a true hacker probably *would* prefer to issue the instruction himself. But I think it is safe to assert that the Lisa is not intended for hackers.

It would be nice to be able to get into the operating system directly, but this option will not be available for several months yet.

The idea that icons are insulting to executives probably stems from a sense that executives are somehow above plebeian charms, too sophisticated to appreciate the image of a folder as a symbol for a set of files. I think the fact that executives tolerate wastepaper baskets in their offices suggests that they will not be offended by icons of wastepaper baskets on their terminals.

The desk metaphor promotes the "messy desk" style of work; computers should help us move away from paper, file cabinets, and folders. Maybe. It does seem a bit silly to spend \$3500 on a machine that lets you think you are working on an \$800 desk. But Lisa does improve on that style. While it is true that the Lisa buries one sheet on top of another, the screen area prohibits you from having too much in front of you at one time. More important, the Lisa reminds you to put your files away neatly; if you choose to ignore that advice and turn the machine off anyway, the Lisa will put the files away for you before allowing the power switch to take effect. Thus you are guaranteed that your files will be kept straight and complete. Furthermore, when you turn the machine on the next morning, your files will come back onto the desk top just the way you left them. Maybe computers should be encouraging us to move away from papers and folders; if so, the Lisa is a good first attempt at helping us make that transition. ED

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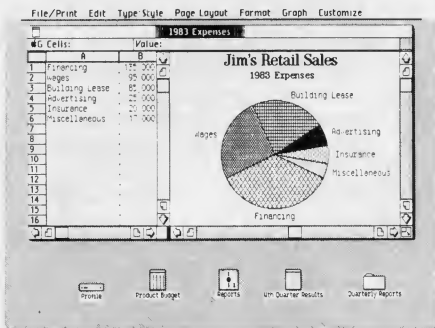
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LisaGraph allows *immediate* updating of a graph simply by typing the correction in the table, which is also on the screen. The glaring mistakes have to do with basic features that other graphing programs have long since taken for granted. Let's examine each type of graph.

The only bar graph permitted is vertical; horizontal bar charts do not exist as far as the LisaGraph designers are concerned. One may not stack bar graphs nor display bars partially hidden behind one another. The fill pattern used is preset and may not be modified. I have found this last restriction particularly annoying. It is as if the designers have taken the attitude that they know what looks best for my graphs.

Line graphs and scattergrams use preset plotting symbols, but these draw much less negative reaction from people. Still, it is annoying to be unable to change the plotting symbol because when two points are plotted close together, the combination of symbols sometimes looks like another. Without the ability to change this default, the user is stuck with confusing graphs.

I have saved the most egregious mistake for last: not only are the fill patterns for the pie charts preset, but so is the *order* of the pie slices. The order chosen by the designers is clockwise from the largest slice to the smallest, regardless of the order in which the slice sizes were entered; the largest slice is centered around the "south pole" of the pie. While this unchangeable default does not seem so bad at first glance, consider the case in which you wish to compare two years' worth of information by putting two pie charts side by side. If the relative shares of the pies have changed greatly from the first to the second year, then the order and the fill pattern of the shares will be different for the two charts, making any comparison difficult to follow.

Having said all this, let me back off a little and mention that most of the above problems can be mitigated by copying and pasting the graph in question to LisaDraw. Once there, bar graphs can be stacked, fill patterns and order can be changed, and more. (But it is not possible to reorder pie charts because the

pieces cannot be rotated.) My point is that one should not have to invoke another program for features that are by convention and common sense considered part of a graphing package.

LisaDraw

LisaDraw is a package for which I have almost unreserved praise. I say "almost" because the lack of dotted lines and the omission of the ability to rotate figures prevents this package from being a truly magnificent example of friendly programming. I cannot do justice to the glories of LisaDraw here, but let me mention my favorite feature.

Suppose you are drawing an organizational chart and need many rectangles in a column, each connected by a hierarchical line. After drawing the first

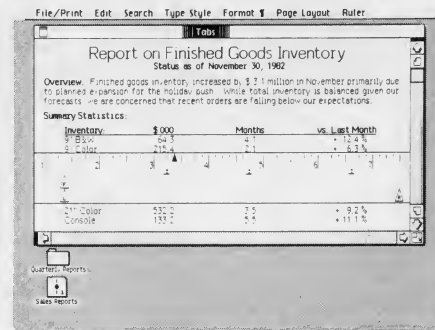


LisaDraw is a package for which I have almost unreserved praise.

rectangle, the line, and the second rectangle, you duplicate the second rectangle. Lo and behold, the rectangle is reproduced not in a random or preset spot, but right where you wanted it—the same distance down from the second rectangle as that rectangle was from the first rectangle, line and all. I do not know how Apple went about designing the Lisa software, but each package has its own feel and little touches, despite similarities of appearance. It therefore seems likely that different programming teams were formed to handle the individual packages, and some teams did better than others. The LisaDraw group did a truly amazing job.

LisaWrite

I do not know what to say about LisaWrite. Most of the pieces of a word processor are there, but somehow they do not all add up to a word processor. Part of it is the overall sluggishness of



the Lisa, which is most pronounced in LisaWrite. Everything seems to take longer than it should, and sometimes this leads to errors. For example, a fast typist can insert a phrase, move the mouse to another area of the screen, and rake through (select) a few words before LisaWrite catches up. The result is that the selected words do not get highlighted and the process must be repeated.

In addition, the screen often rewrites itself for no apparent reason. Even more annoying, LisaWrite sometimes puts you back at page one for no good reason. For example, if I am in the middle of a document and want to find out where the page break is going to be by selecting Preview Pages from the menu, LisaWrite throws me back to page one. Now I have to find where I was again. Another example: selecting the "landscape" option, allowing me to type on an 11" wide sheet of paper and then going back to the "portrait" option (11" long) puts me at the *end* of the document. If there is nothing at the end of that last page, I see nothing but a blank screen.

The lack of a choice in the paper size is a rather incredible oversight, especially when the other packages seem to go to great lengths to offer elbow room. But LisaWrite provides only the 8½" by 11" size. (Inexplicably, there is no elevator to allow quick left to right scrolling when you are trying to type so that the 11" represents the width of the paper.)

Another inexplicable annoyance is that the backspace key does not work when the shift key is depressed; instead, random characters are sometimes written to the screen.

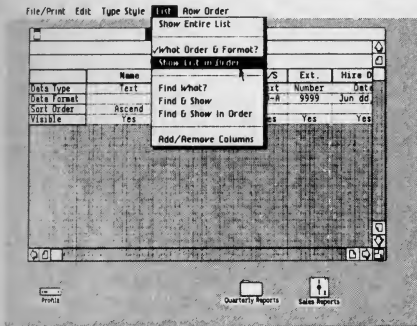
The main point I have to make after months of using LisaWrite is that Apple would better spend its time making the current features work smoothly and easily rather than adding new features.

LisaList

The most important limitation in the database management program is that a user cannot search by imbedded keys within a field. The entire field must be searched as a unit. Furthermore, no wild cards are allowed. The 80-column field limitation means that lengthy "note-

book" entries are not possible. The lack of number manipulation detracts severely from the usefulness of the LisaList because the current version does not permit the user to cut and paste the numbers into LisaCalc for calculation. The lack of Boolean algebra limits the searches to simple ones (=, <, >, <>, and THRU).

Particularly annoying is the lack of a record count when a search is performed, forcing the user to count each line on the screen to determine the number of records that fits the search. Given the international flavor of the Lisa (an alternate set of international characters is supplied), I was surprised to find that some of the default fields do not permit custom designing. For example, the zip code field requires either five or nine



LisaList is a nice, reasonably powerful, personal database management program.

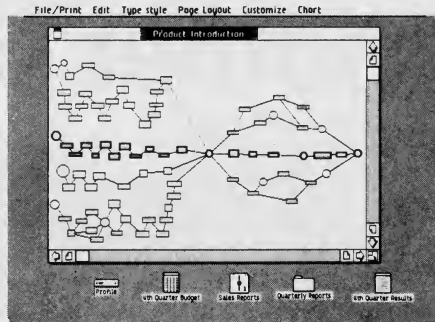
digits, which makes the default unusable for Canadians who have a mixture of letters and numbers in their zip codes.

In short, LisaList is a nice, reasonably powerful, personal database management program. It has a long way to go before it can hold its own against the big boys like *dBaseII*.

LisaProject

The single most disconcerting feature missing in LisaProject is the ability to keep track of the cost of tasks. While many projects rely on people's time and tasks only, many others, such as constructing a building, have a cost associated with tasks and resources. LisaProject does not allow the user to follow the effect of costs through the project, and that is a serious flaw in a program whose purpose is to allow a manager to plan and monitor a project.

While it may seem important, the fact that LisaProject does not use linear



programming to solve the critical path problem is not a serious flaw. There are other algorithms that yield near-optimal solutions and are much faster than linear programming algorithms.

Documentation

There are seven 9" by 10" looseleaf binders: one owner's guide and six documents for the six application packages. All of the documentation is structured the same way: Table of Contents, Getting Started, Tutorial, Reference Guide, Appendix, and Index. Compared to most of the other documentation on the market for microcomputers, the Lisa documentation is rather good. The tutorials are especially handy in quickly getting a user familiar with a particular application package. And it is a joy to have an index. In keeping with the spirit of this article, however, I will highlight my main problem with the current documentation.

The Reference Guide in each documentation is woefully inadequate. As an example, consider LisaProject. The documentation mentions that linear programming is not used and that therefore the critical path displayed may not be optimal, but it does not then say what algorithm *is* used. Without such information, the user has no way of knowing whether his particular application falls into the class of problems that do not yield an optimal solution with the LisaProject algorithm. Likewise, the limits of each package are nowhere discussed. The only way one learns about the limitation of nine bar graphs in LisaGraph is by trying to enter ten of them. And I defy anyone to say honestly that he understands the Search function in LisaCalc after reading the instructions once.

The point I want to make here is that the documentation adds little to what the user can learn by using each of the application packages. Part of the reason for this is that the Lisa truly is easy to use, and it is with no small pride that some people claim that they have used their Lisas for months and have never had to refer to the documentation. But documentation that does not inform the user about the limits of the machine is

insufficient in a high-end system. Much of my need to write this article would have been obviated if the documentation had been complete.

Bugs

I have found one serious bug and a few annoying ones. The one serious bug is that it is possible to lose pages temporarily in LisaWrite if one types in large blocks of text while the Preview Pages selection is in effect. Preview Pages numbers the pages and inserts the appropriate spacing between pages. On several occasions, when inserting large paragraphs toward the beginning of a 20-page document, I found—not without some horror—that the document appeared to have been truncated at page 4. The elevator on the right shakes and sometimes disappears entirely. So far I have always been able to recover the lost pages by either reverting to the previous version, duplicating the file and then saving or just plain saving. I suspect the pages are not really lost, but the experience is nonetheless unnerving.

Support

When you purchase a Lisa, you receive an 800 number to call if you need support. I have used this service several times and have usually been able to get through the first time. The people responding to my questions have always been courteous and helpful, especially in providing information about updates, new products, and the timing of new software and hardware releases. I have found them most useful in dispelling or confirming the rumors that seem to hover about the Lisa.

Local dealer support has been good overall. The on site service agreement is expensive, but well worth the saving in trips to the store and hourly billings. My chief complaint with local support is that my dealer seems ill-informed about new releases and updates for the Lisa, but this may be the fault of Apple, and not my dealer.

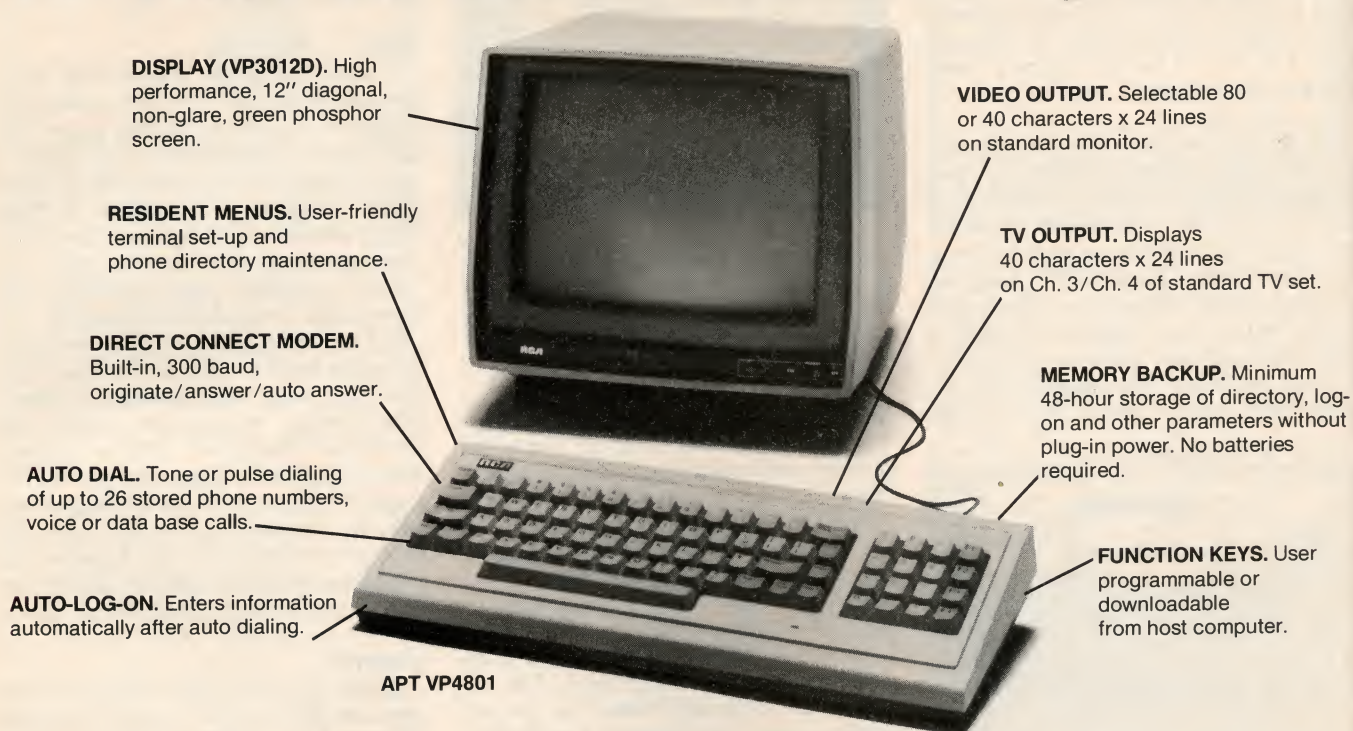
Summary

The Lisa is a wonderful machine that lives up to many of the expectations that have surrounded it. The Lisa has set new standards for the phrase "easy to use." No machine will ever be perfect, and I have attempted to describe some of the problems with the Lisa in this article.

Its shortcomings notwithstanding, I am more than satisfied with the Apple Lisa and look forward to the improvements promised by Apple. The fact remains that there is simply no other microcomputer on the market at any price with the Lisa's powers. I would not hesitate to purchase my two Lisas again.

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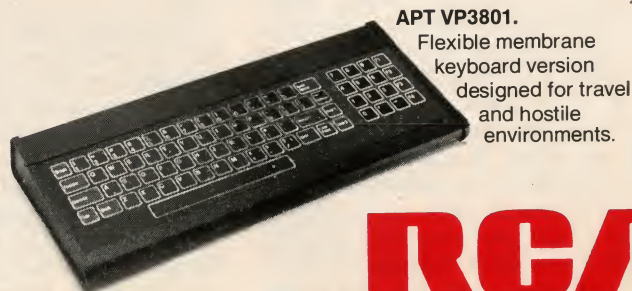
OTHER FEATURES

RS232C port for direct computer connections at data rates to 9600 baud, or for connecting high speed modems and other accessories. Parallel printer port for hard copy. Numeric keypad, can dial phone numbers not in terminal directory. Built-in speaker with adjustable volume control for audio monitoring of phone line. Smooth scroll display. Automatic screen blanking to reduce possibility of burn. Briefcase size: 17" x 7" x 2". Weight: under 4 lbs.

Quite simply, matching features with price, there is no other professional quality terminal available today that can do as much at such low cost.

APT terminals list for \$498, in your choice of full stroke or membrane keyboard versions. Either style is also available with a display monitor for \$697 list. The data display monitor alone, VP3012D, \$199 list.

For more information—or to order—call 800-722-0094. In Penna., call 717-295-6922. Or write for fully descriptive brochure to RCA Data Communications Products, New Holland Avenue, Lancaster, PA 17604. OEM and dealer pricing available. The new RCA APT. Expansive. Not expensive.



APT VP3801. Flexible membrane keyboard version designed for travel and hostile environments.

RCA

CIRCLE 119 ON READER SERVICE CARD

Fujitsu Micro 16s



David H. Ahl

According to Fujitsu, the Micro 16s was designed for the U.S. market—more specifically, for the business user. Key features are two user-accessible micro-processors (an 8-bit Z80A and a 16-bit 8086), and CP/M-86, under which the Z80 can run software designed for CP/M 2.2. Running the optional Concurrent CP/M-86 allows the Micro 16s to perform up to four computing jobs simultaneously.

The Micro 16s contains 128K of parity checking memory (expandable to one megabyte). An additional 48K is built in for high-resolution color video support.

The bundled system comes with CP/M-86, *WordStar*, and *SuperCalc*. Concurrent CP/M-86 and MS-DOS are optional. Other software is available from dealers, but not from Fujitsu. Interestingly, Fujitsu makes no high level programming language available for the Micro 16s—no Basic, no Pascal, no Cobol, no Ada. According to the specifications, the system “supports all standard language processors,” but whether they take advantage of the high-resolution graphics or other extended capabilities of the machine we can’t say. The lack of a high level language, of course, is consistent with the marketing philosophy of aiming the Micro 16s at a business customer looking for a turnkey system.

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HARDWARE PROFILE

Product: Fujitsu Micro 16s

Type: Small business computer

CPU: 8-bit Z-80A and 16-bit 8086

RAM: 128K

Keyboard: Detachable, 98 full-stroke keys

Text Resolution: 80 chars x 25 lines

Graphics resolution: 640 x 200 pixels

Colors: 8

Ports: Parallel, serial, light pen
4-channel A/D

Dimensions:

System unit: 19.5” x 15” x 6”
Keyboard: 18.3” x 7.7” x 1.3”

For the fanatic programmer, the 8086 mpu is accessible and the second section of the CP/M-86 manual provides documentation for assembly language program-

Documentation: User’s Guide, Manuals for CP/M-86, *WordStar*, and *SuperCalc*

Summary: Dual processor business system able to run both 8-bit and 16-bit software packages. Rugged design, excellent keyboard. Comes with CP/M-86, *WordStar*, and *SuperCalc*.

Price: \$3995 for bundled system; monitor is extra.

Manufacturer:

Fujitsu Microelectronics, Inc.
3320 Scott Blvd.
Santa Clara, CA 95051
(408) 980-0755



Keyboard has standard alphanumeric portion. Function keys, special keys, and numeric keypad are all separate. Cursor keys are arranged in a reasonably logical way.

ming. The first line of this manual put us off a bit, "The reader should also be familiar with the 8086 assembly language instruction set, which is defined in Intel's 8086 Family User's Manual." Gag.

Okay, so we'll skip the programming in this evaluation and look at the Micro 16s as turnkey business system.

Setting Up

The Operations Guide with the Micro 16s provides extensive illustrated instructions on unpacking, setting up, and getting started. With the assistance of this guide, it took us about one-half hour to unpack and get our first disk loaded.

As we set up, the quality of the components was very evident. The system unit is in a heavy metal cabinet. Measuring 19.5" x 15" x 6", it is just a tad smaller than the IBM PC. A rocker power switch is recessed on the right side toward the back, and a reset button is recessed toward the front.

On the rear of the system unit are connectors for the keyboard, light pen, A/D, monochrome and RGB monitors, parallel printer (DB-25 connector), RS-232 serial device, AC in, and AC out (for the monitor).

Accessible through an open slot in the bottom of the front panel are 16 DIP switches. These are not described in the manual except in one illustration showing how they should be positioned for correct operation of the monitor.

On the back of the system unit are four rectangular covers. One or more of these covers can be removed when boards are plugged into one or more of the five 130-pin expansion slots. Hmmmm, 130 pins? That's not like anything of which we have ever heard. Nor is any information provided in the documentation. Guess we will have to wait until Fujitsu announces some add-ons or peripherals to see what plugs into these slots.

The system unit contains two double density, double sided 5 1/4" floppy disk drives with a formatted capacity of 320K

each. An LED on each drive shows when a disk is being accessed. After a disk access, the drive keeps spinning for several minutes, thus speeding up subsequent accesses.

The system unit contains both a 16-bit 8086 mpu and an 8-bit Z80A, 128K of parity checking RAM (expandable to one megabyte), 48K of video memory, four-channel analog-to-digital converter, and interface circuitry.

Detachable Keyboard

The detachable keyboard is attached to the system unit with a cable, part of which is coiled and part of which is straight. In all, it stretches to almost six feet.

**With both
8-bit and 16-bit mpus,
the Micro 16s can
run software under
both CP/M 2.2
and CP/M-86.**

The keyboard has 98 sculpted keys including a truly standard alphanumeric keyboard, numeric keypad with arithmetic operations, ten function keys, ten special keys, and four cursor movement keys (arranged in a reasonably logical pattern). A nice touch is the LED next to the CAPS LOCK key (which indicates whether it is on), and similar indicator by the INSERT key. The RETURN key is a hefty four times the size of the standard keys.

Backspace is a destructive backspace and is where it belongs—over the RETURN key. Unlike some computers, backspace and left cursor movement are different keys, a nice touch.

A GRAPH key is used to obtain graphics characters from the keyboard; this is not

a toggle key but must be held down with the desired regular key. ALT has a similar function and causes an "alternate" character set to be entered. In total, the keyboard is capable of generating 96 standard letters, numbers, and symbols; 32 graphics characters; 39 Greek letters; 10 reduced size numerals; and 26 math, music, and scientific symbols.

The keyboard has some interesting fixed function keys including insert, delete, erase line, clear screen, home cursor, and duplicate (functions differently in different software packages).

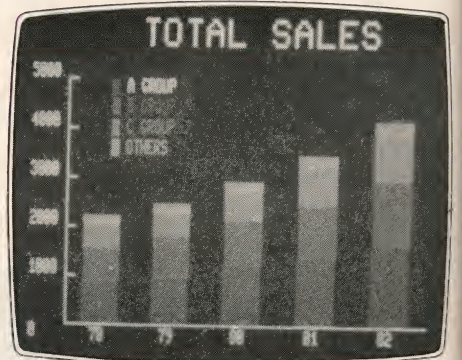
A keyclick sound can be toggled on and off with the KCLICK command in CP/M. This produces a quiet click which is useful when holding down a key for repeated entries. All keys repeat when held down for about one second.

The standard alphabetic, numeric, and symbol keys are white with a black label, and all the other keys are medium gray. The area immediately surrounding the keys is tan, while the keyboard assembly is light cream. This color scheme is also used on the system unit and manual binders. In an informal office poll, we felt the system was reminiscent of a 1950's car—two-tone and fins—but the appearance was not indicative of the quality of the system.

High Resolution Display

Two monitors are available from Fujitsu for the Micro 16s, a 12" monochrome (green screen) unit and an 11" RGB color unit. Our system was equipped with the color unit.

Text resolution is either 40 or 80 characters by 25 lines. Although the SCREEN command (in CP/M) permits setting all kinds of variables, we never did figure out how to display a 40-character line. On the other hand, SCREEN lets you specify the number of lines on the screen, the number of scrolled lines, display colors, and whether or not to display the real-time clock.



Graphics resolution is 640 x 200 pixels. With the color monitor, eight colors are available. The video memory for graphics and characters is separate, so they can be displayed independently. Different software

packages make use of the color capabilities in various ways. *SuperCalc*, for example, uses white for user entry, blue for spreadsheet labels, and light blue for function key labels—unobtrusive and effective.

An optional swivel pedestal is available for the monitor. This unit raises the monitor from the table or system unit about 2 1/2" and tilts from about 5 degrees forward to 20 degrees back, and turns 45 degrees to either side. We found it a nice accessory that helped compensate for various room lighting conditions.

CP/M-86 and CP/M 2.2

When the system is first started (with no disk in the drive), the following message appears on the screen:

DISK ERROR 0A

(R, H, D, S, O, X or G)

The manual tells us, "This is normal... Since there isn't a disk in drive 0, the Micro 16s displayed the error message." What do the letters mean? Who knows? Apparently, this is in keeping with the Fujitsu philosophy of not confusing the customer with extraneous information. The manual simply directs you to put a disk in drive 0, and press reset. Okay, that's what we did, but we would still like to know the meaning of R, H, D, and so on.

CP/M-86 is an operating system designed by Digital Research for the 8086 mpu. It is compatible with standard CP/M for 8080 and Z80 mpus. This means that if the disk formats are the same, as in the single density format, CP/M-86 can read the same data files as CP/M. This means that applications programs can be relatively easily converted to run under CP/M-86.

CP/M-86 can support up to one megabyte of internal RAM, 16 logical disk drives of up to eight megabytes each, and several other devices.

Since the Micro 16s has two micro-processors, CP/M 2.2 programs do not have to be converted, but will run directly as loaded. Actually, the CP/M 2.2 disk will not boot up itself; instead, CP/M-86 is loaded, and then the desired CP/M 2.2 applications program may be loaded and run. The only restriction is that programs must be "pure" CP/M 2.2; this means that all calls to hardware must be through normal CP/M calls. We tried running CP/M 2.2 versions of *Perfect Calc*, *Perfect Writer*, and some other programs with mixed results. Some loaded and ran, but all too often we got a meaningless error message such as "disk not ready;" or "I/O error." We are not sure why—perhaps these programs used a direct hardware call (doubtful) or a non-standard CP/M call (possible).

The manual is thorough and seemingly written especially for the Fujitsu Micro 16s. Indeed, except for failing to describe the error line resulting from a no-disk

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start, the manual is one of the most comprehensive on CP/M that we have seen, running 152 pages in the user section and another 180 pages in the assembly language programming section.

WordStar

WordStar. What can we say? It is perhaps the most widely used word processor for microcomputers today. It is an exceptionally comprehensive package and has many custom features and enhancements on the Fujitsu Micro 16s.

Perhaps the biggest improvement in *WordStar* over the years has been in the documentation. Today, the manual still runs a whopping 224 pages in the main section, 31 in the appendices, 60 in the training guide, 50 in the installation section, and 17 in custom features. Nevertheless, the manual is much more readable and approachable than earlier versions.

The Fujitsu Micro 16s is aimed squarely at the "typical" business and professional user who wants word processing, a spreadsheet and other off-the-shelf software.

Using the Short Course (40 pages), you can get up to speed on *WordStar* in about two hours. However, to take advantage of its many extended features will require study, practice, and experimentation over a span of weeks or months.

Some of the custom features on the Micro 16s allow *WordStar* to take advantage of the print enhancement features of the Epson MX-80 printer, ring a bell (actually a beep) on error, and use different colors for displaying text, prompts, status lines, and help.

SuperCalc 2

SuperCalc 2 is Sorcim's spreadsheet package which has been nicely customized for the Micro 16s. *SuperCalc 2* is a second generation spreadsheet and has all the commands we have come to expect in a spreadsheet with the addition of automatic sorting of rows or columns, formatting of text as well as numeric entries, protection of cells or ranges of cells, logical functions, calendar functions, net present value function, and several other goodies.

On the Micro 16s, *SuperCalc* is cus-

tomized to take advantage of ten built-in and two programmable function keys, and use color in the screen display.

The manual is directly from Sorcim and reflects their years of experience marketing the package. As with *WordStar*, an eight-panel reference card is furnished with the package.

Options and Questions

The specifications on the Micro 16s mentioned several things which we did not have the opportunity to try. Obviously, external disk drives are available, both 8" floppy disk drives and 5 1/4" Winchester drives with 10 or 20 megabytes of storage.

As mentioned earlier, interfaces are provided on the system unit for a light pen and four-channel A/D converter. We have no further information on these accessories.

We are told the Micro 16s can be linked to the Omninet communications network system developed by Corvus. This allows the Micro 16s to serve as an intelligent node in a larger network, sharing resources and programs with other machines. We had a Corvus System on the next table for evaluation, but none of the documentation with either system gave a hint on how to make them communicate with one another.

And, as we mentioned earlier, we are curious to see what goes into those 130-pin expansion slots.

For Business Use Only

As it is bundled (CP/M-86, *SuperCalc*, and *WordStar*), the Fujitsu Micro 16s is aimed squarely at the "typical" business and professional user who wants word processing, an electronic spreadsheet, and little else. Although the system is capable of running a much larger library of software, the customer today will have to rely upon his dealer to get these packages and install them on the Micro 16s. The choice of packages is wide as a result of the Micro 16s being able to run 8-bit CP/M 2.2 applications as well as ones written for the 16-bit systems, CP/M-86, MS-DOS, and Concurrent CP/M-86.

We are disappointed that Fujitsu has chosen not to license Microsoft Basic directly and offer it to their customers. The hardware is exceptionally capable, and it seems that the manufacturer ought to make it as easy as possible for the user to take advantage of its many features.

In summary, the Fujitsu Micro 16s is a no-nonsense desktop computer. It is not portable; nor does Fujitsu pretend that it is. It is rugged and stylish (in a 1950's sort of way), and has a truly standard, user-friendly keyboard. At \$3995, the Fujitsu Micro 16s is a full-featured, capable system, and, backed by Japan's largest computer manufacturer.

END
CIRCLE 488 ON READER SERVICE CARD



HP 150

Personal Computer

Shel Talmy

Hewlett Packard has introduced the Series 100 HP 150 personal computer that places computing at your fingertips—literally. The touch screen allows, as Hewlett Packard puts it, the use of nature's most perfect pointing device—your finger. The touch electronics that allow you this luxury, the system processor unit, video display and control circuitry, 256K memory, and three I/O ports are all packaged neatly in a machine that occupies only about one cubic foot—and that includes space for an optional thermal printer with its own connecting cable that fits into a cavity on top of the display unit.

The term "touch screen" is more descriptive than strictly accurate. The screen itself is not sensitive, but is composed of an invisible 27 x 40 grid of light emitting and photo diodes that correspond to options offered by the various application programs. This provides the ability to implement commands by touch on each row of the display and every two columns.

When you choose the item you want, you press the desired box and the cross-hatched infrared beams are broken,

converting your choice into computer commands. The space provided for your finger is more than adequate, so you should never encounter the problem of overlapping—unless, of course, you are

Andre the Giant or Paul Bunyan.

Operating System

The HP 150 Personal Computer uses MS-DOS 2.0 from Microsoft Corpora-

HARDWARE PROFILE

Product: Hewlett Packard Series 100 HP 150 Personal Computer

Type: Small business computer

Operating System: MS-DOS 2.0

CPU: 16-bit Intel 8088

RAM: 256K standard, expandable to 384K, 512K or 640K. Also 6K of static RAM for the screen.

ROM: 160K

Keyboard: Detached, 107 full stroke keys

Disk Drives: Comes with dual 3.5" Sony format micro diskette drives

Display Screen: 9" diagonal with "HP Touch" sensitive to every row and every two columns.

Text Resolution: Up to 80 characters x 24 lines with three additional lines for screen labels and system messages.

Graphics Resolution: Monochrome 512 x 390

Sound: Single tones only; no tone generator

Ports: 2 RS-232 serial, 1 HPIB interface bus

Documentation: Owner's manual, Terminal User's handbook, and manuals with each applications software package.

Pricing: System including Systems Master and Applications Master Computer Tutor, Demo Disk and P.A.M. (Personal Applications Manager) \$3995. All applications programs are extra.

Summary: Excellent, compact system. Innovative Touch Screen interface and high resolution graphics.

Manufacturer:
Hewlett Packard
3000 Hanover St.
Palo Alto, CA 94304
(800) 367-4772

tion as the standard operating system. HP has enhanced MS-DOS so that all the touch screen features are supported by the operating system. The keyboard "softkeys" and the graphics display can all be accessed through MS-DOS.

The Basic System

The HP 150 as received from the manufacturer consists of three components: the CRT, which HP calls the display unit; dual 3½" micro floppy disk drives; and a detachable keyboard. The package includes the Systems Master disk with MS-DOS, the Systems Applications Master, a demo disk and the Computer Tutor, plus the User's manual and a Terminal User's handbook. The price is \$3995. With easy to follow directions and illustrations to guide you, it takes very little time to connect the components. I was up and running in about ten minutes.

The HP 150 uses the 16-bit Intel 8088 microprocessor and runs at a clock speed of 8MHz. The system comes standard with 256K RAM plus an additional 6K of RAM for the screen and 160K of ROM totaling 422K in all.

The CPU is contained in the display unit, and all connections and ports are on the back. There are two card slots that can be used for extra memory, IBM

The HP philosophy is that the user's workspace should be available for the assortment of oddments normally found on a desk.

emulator card, or a modem. Two RS-232 serial ports are provided along with an HP-IB (interface bus). More about that later. The 9" CRT is green phosphor. I queried HP about this, as the small size is unusual for a desktop computer of the non-portable variety. Here are the reasons they gave me for the choice:

First, they were concerned that a desktop computer should not occupy the entire desk top. The HP philosophy is that the user's workspace should be available for the assortment of oddments normally found on a desk, and indeed, the entire system, display, processor, keyboard, floppy and Winchester (optional) disk drives, and integral thermal printer (also optional), occupies only 2.1 square feet of space—about the same as



The HP 150 has a relatively compact footprint (11 x 13") compared to the IBM PC (16 x 20"). On the other hand, the keyboard is a largish 18 x 9".

an open loose leaf notebook. The CRT, which is 12" x 12" x 11.3" fits neatly on top of the disk drives, which measure 12.75" x 11.25" x 3.125". The keyboard, which clips into the back of the CRT with a standard phone jack, measures 18" x 8.9" x 1.4".

The second reason HP gave for the small monitor was sharpness. The CRT is of high quality and the screen resolution is excellent (the alphanumeric display is 720 x 378), although the size of the characters displayed (1.3mm x 2.8mm) might cause a problem for the farsighted individual with short arms.

Micro Diskettes

In keeping with the "small is better" philosophy, the HP 150 uses the Sony format 3½" micro diskettes. The micro floppies are encased in a hard plastic cover, and a metal shutter protects them when not in use—a very nice feature. These micro diskettes have a nice solid feel to them, and in my opinion are



Touch screen is efficient and reliable.

much easier to handle than the 5¼" floppies. They slide into the drives with no gates to close and pop out as would an 8-track tape when you push the eject button.

The major drawback of these diskettes is storage space; they offer only 270K per diskette. HP told me that 540K diskettes will be available "sometime" in 1984, and that ultimately there will be a format available with more than one megabyte of usable space. One last point about micro floppies: prepare yourself to write very, very small—there isn't much room on the labels.

The Keyboard

The keyboard too, has a nice feel about it. The keys are sculpted and matte finished in three colors for easy differentiation between function and typing keys. The 107-key keyboard contains the full local editing keys such as cursor control keys, display scrolling keys, Next and Prev keys for scrolling by pages (as well as allowing application programs to use them for the selection of alternative choices), and Insert and Delete keys for inserting and deleting single characters or entire lines.

The function keys are screen labeled so that you have the option of using the function keys or the touch screen to implement an application. There are also special keys that perform dedicated functions. The Menu key is used to toggle the screen labels on and off, and the Control, Shift, and Menu keys, pressed simultaneously turn the touch screen on



The touch screen uses a 27 by 40 grid. Any of the 1080 locations can be "read" independently of the screen display.

and off. The key labeled Reset Break turns the computer into a terminal.

Shift and Reset Break gives you a soft reset, which clears the keyboard lock and screen error messages. It also turns off display functions, stops printing, and resets the internal printer. Control, Shift and Reset Break gives you a hard reset which restarts the operating system from disk A.

User System shows the last system keys used, and Shift, User System displays function key labels used by the current applications program. Clear Line clears a line from the cursor position to the end of the line, and Shift, Clear Line blanks out the line containing the cursor. Clear Display deletes all characters after the cursor from display memory and Shift, Clear Display clears all lines from display memory. The 18-key numeric pad can be shifted into a graphics pad by pressing Control and the minus sign on the numeric pad.

The CRT

The CRT can display 1920 characters in a 24-line by 80-column format. The 25th and 26th lines are used for the screen labeling of function keys, and the 27th line is for system status and error messages. The screen memory stores two pages of text, which allows off-screen storage display for scrolling vertically without interrupting the processor. The standard display is green characters against a black background. The graphics resolution is 512 x 390 pixels.

HP says the aspect ratio of 1:1 guarantees symmetry so that circles will look like circles not only on the screen but when transferred to an HP graphics printer.

The numeric keypad also serves as a graphics keypad, allowing you to turn

the alpha and graphic displays on and off, clear the graphics display, and transfer the graphics display to an HP graphics printer. It also displays the graphics cursor and allows it to be moved around the screen.

Peripherals

The HP 150 Interface Bus enables you to daisy chain up to 15 HP peripherals to one I/O port. In addition to the 3½" micro diskette drives that come standard, the 150 can be configured with 5¼" disk drives or Winchester hard disks—up to eight drives. The Winchester comes in 5 or 15 megabyte versions, and up to 120 megabytes of on-line storage can be utilized by the system. The Winchester disk drives fit under the system and so do not encroach on the workspace.

P.A.M.

The HP 150 comes with a supervisory program that is called P.A.M. (Personal Applications Manager). P.A.M. is used as a coordinator to translate the function you have touched on the screen into computer commands. Another way of putting it is that P.A.M. is a shell you use instead of typing MS-DOS commands. Application programs from all disks are listed on the screen. All you do is touch the program desired, which is highlighted, and then touch the start application label that is called Start Applic. The 150 emits audible "clicks" reminiscent of contented crickets on a drowsy summer evening, to let you know that you have made contact.

If, for some reason, you want to do this from the keyboard, you can accomplish this by using the tab keys to position the arrow on the desired program and pressing the select key. P.A.M. can:

start an application program, set the date and time in the HP 150 clock, list all installed application programs on available disks, start the File Manager, help you by giving some simple explanations, and make the HP 150 act like a terminal. The HP also gives you the option of using the keyboard commands or the function keys that correspond to the labels on the screen (softkeys).

P.A.M. is loaded automatically when the operating system is booted. If you are already using an application, you can always get to P.A.M. by exiting that application. As soon as you leave it, P.A.M. returns to the screen.

The beauty of P.A.M. is that you can perform all file functions without learning a single MS-DOS command. Is that a cheer I hear from the novice computer users struggling to memorize computerese?

The Procedure

When you boot the system, P.A.M. comes up automatically and displays the application programs available on all drives. In addition, it provides disk applications, accessed through P.A.M. These disk applications are menu-driven and use "HP Touch." The choices are MS-DOS Commands, Format, and Device Configuration. Choosing MS-DOS Commands loads them into memory and gives you an A> so that you can operate your computer like any standard non-touch system. The other two choices, Format and Device Configuration are self explanatory.

At the same time the screen also displays labels that allow you to start an application, set the date and time, reread the disks, make your computer a terminal, get a help menu, or use the File Manager. The File Manager gives you the necessary functions to run your system—delete, copy, choose a directory, rename, etc.

When you use your finger to break the vertical and horizontal beams, the system recognizes this by highlighting the spot you touch in inverse video. You can, in fact, move your finger over the entire screen and watch the highlights in your wake. The system will not react until you remove your finger, allowing the beams to reconnect and zero in on the closest photo receptor to your selection.

To use the Install program, which is part of the Applications Master, for example, press Install—it lights up. Touch Start Applic; Install loads into memory and allows application programs to be added or removed from the Applications Selection menu of P.A.M.

Another program on this disk is Set up P.A.M. This disk application lets you arrange the names of application programs on the Applications Selection

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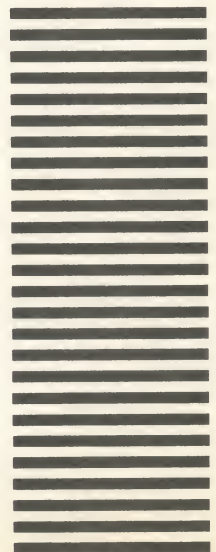
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Best Connection

ProModem™ 1200A Apple Card Pack



It's the best 300/1200 baud 212A telephone modem for your Apple® II, II+, and IIe. "Best" because it's the easiest to install and use, provides more useful modem features for your money, and lets you add software capabilities as your needs grow.

We really do mean easy. Just plug the ProModem Card Pack into any expansion slot and connect the telephone cord. On-board intelligent software in ROM includes a simple but powerful terminal program. With a few keystrokes, you'll be "on line" and communicating.

ProModem 1200A offers you the best price-to-performance modem available with Auto-Answer and Auto-Dial, Programmable Intelligent Dialing, Built-in Speaker with Volume Control, Help Commands, Extensive Diagnostics, and more.

And when you need more sophisticated capabilities like Terminal Emulation, you're all set.

The 1200A is fully Hayes compatible. You'll be able to use most of the Apple II communications programs available.

PRICE COMPARISON

PROMETHEUS

- (1) ProModem 1200A Apple Card Pack, complete with on-board software and all necessary hardware
List Price: \$449

HAYES

- (1) Smartmodem 1200 "standalone modem"
- (2) Serial Card
- (3) RS-232C Cable
- (4) Communications Software
Total List Price: \$957

The "Help" Screen and "Auto redial if busy" functions make the 1200A convenient to use. The second phone jack for the telephone handset allows switching from voice to data. You get all of this, ready to use, complete with easy to understand documentation, and a telephone cord for only \$449.

See your local dealer for a demonstration. He'll show why ProModem 1200A is your best connection.

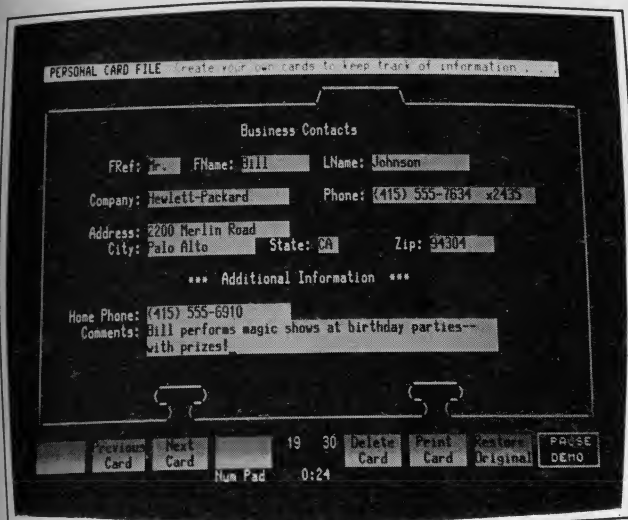
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Fremont, CA 94538
(415) 490-2370

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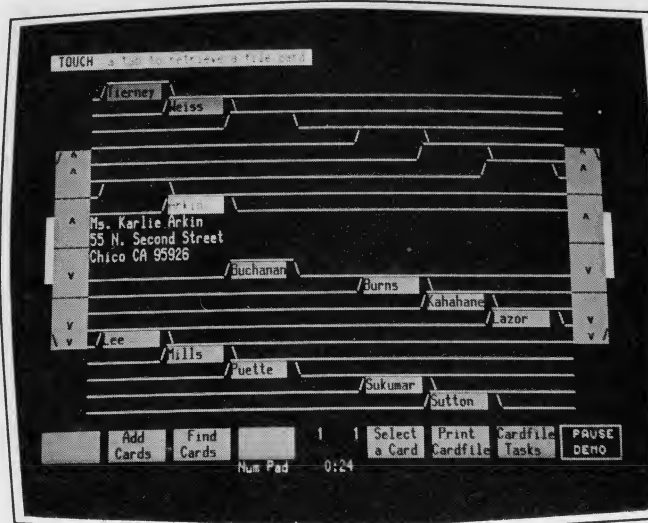


PROMETHEUS

CIRCLE 211 ON READER SERVICE CARD



Individual card plus softkeys for PC7.



View of whole card file plus softkeys.

menu in the order you want, and you can autostart any frequently used application from a cold boot.

In addition to the standard Copy Files option, P.A.M. also has a Backup option that lets you store files in a compressed format, handy for archival storage. P.A.M. also tells you when there is not enough room left on the disk to which you are copying and will politely advise you to change disks.

Enough nuts and bolts for the moment. Let's see how P.A.M. and the Touch Screen apply to the programs you want to use.

MemoMaker

Here is where the true ease of HPTouch asserts itself. *MemoMaker* is a simple word processor that HP says was created exclusively for the casual writer whose main occupation is not writing. *MemoMaker* has several features in common with its more powerful cousin, *WordStar*, and is a breeze to use. It is important to note that *MemoMaker* and *WordStar* are entirely compatible, so a document created in one can be edited in the other. The program sells for \$150.

When *MemoMaker* is implemented, you get the following main menu in screen labels: File Keys, Block Keys, Format Keys, Print Keys, Get Memo, Center Line, Help, and Exit *MemoMaker*. In addition, Line 1, Column 1, appears at the top of the screen so you can just start writing if you are satisfied with the defaults.

Let's assume you are not and want to change the format. Touch Format Keys, and a sub menu appears. This gives you the choices Left Margin, Right Margin, Set Tab, Clear Tab, Margin Release, Help, and *Memo Maker Main*. To set the left margin, move the cursor to the spot where you want the new left margin

to be. You can do this with the cursor key or your finger. In the latter case the cursor will follow your finger there. Touch the Left Margin label and the margin is set.

I should point out, if you'll excuse the pun, that using your finger to set the margins lacks the fine tuning necessary for pinpointing an individual column. I tried it both ways and using the cursor

***MemoMaker has
several features in
common with its more
powerful cousin,
WordStar, and is a
breeze to use.***

key is the outright winner. The same procedure applies to the right margin. To set tabs, you touch one of 16 settings in the form of boxes that appear in the ruler line.

Block commands are just as easy to use. The sub commands give you the choices: Cut Out Block, Copy Block, Paste Block, Align Block, Enhance Block, and Help. To cut out a block of text, for example, move the cursor to the first character of the block and touch the Cut Out Block label. You get a blinking cursor and are advised to "Use the cursor to define a block, then select 'Block OK.'" Move the cursor to the end of the block and touch Block OK. The block of text you have just defined will disappear. You can also underline or put a block of text in bold-face with touch commands.

When you are finished with your memo, you save it under the sub menu from the File Keys option, then press Print Keys. The following sub menu will appear: Double Space, Auto Feed, PRN:*, Page Break, Print Memo, Skip Page, and Help. Choose the options you desire. The PRN:* refers to the printer you wish to use if there is more than one. Touch Print Memo, and you get a hard copy of your latest creation.

This program is easy enough to use, so the novice can be turning out productive work within minutes of sitting down in front of the terminal.

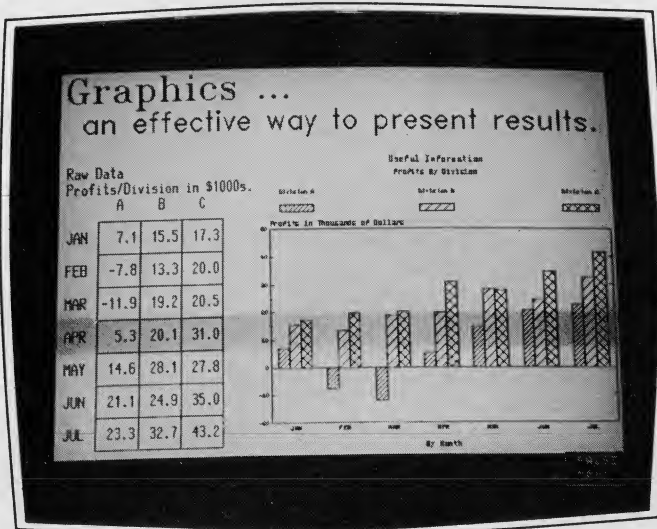
WordStar

I wondered if *WordStar* could be as friendly as *MemoMaker*. This, most popular of all word processing programs, is notorious for its multitude of commands that require prodigious feats of rote memory. Could true happiness be found amid the forest of control-K, control-O, and dot commands? I am delighted to report that, indeed, you can process words without constant reference to lists of *WordStar* commands.

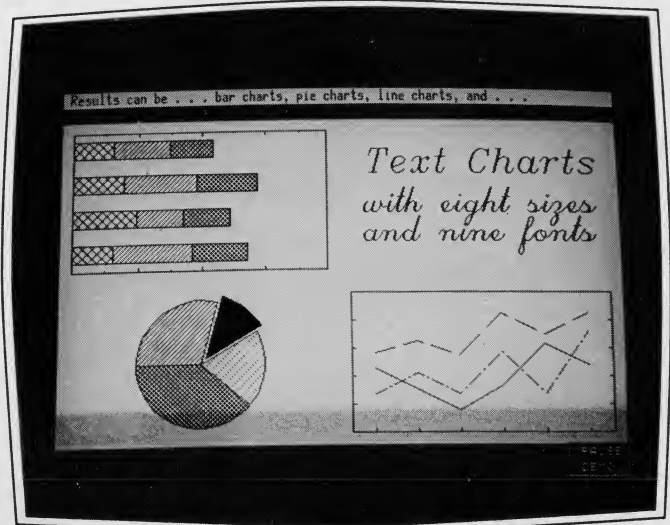
Virtually all of the *WordStar* 3.3 commands are available on softkeys. For many people, the HP 150 will be worth the price for this feature alone. Those with a more traditional turn of mind have not been ignored either. You can still operate *WordStar* with control codes from the keyboard. The Series 100 *WordStar* costs \$500; *SpellStar*, \$250; and *MailMerge*, \$250. Or the entire package can be purchased for \$850.

VisiCalc

Another standard program that no self-respecting computer user can be without is *VisiCalc*, which sells for \$250. The HP 150 version has softkeys that cover most of the *VisiCalc* commands



Graphics Demo.



Graphics Demo.

including an extensive Help menu, and all the functions can be accomplished by touch. Again, HP allows the experienced *VisiCalc* user to work with the conventional "slash" commands.

The novice will not have to bother. Operations are clearly labeled on the screen and can be executed by the touch of a finger. An explanation of each command is available on the display for quick reference without having to open a manual, so that the new user can plunge right into forecasts, budgets, financial plans, and all other types of spreadsheet functions with a minimum of training.

Personal Card File

The *Personal Card File (PCF)* sells for \$150 and is an on screen Rolodex—and much more. The full screen simulation of a rotary card file allows you to flip through the cards by touching the pictured handles, just as you would do with

the three-dimensional version. Touching a tab allows you to view an individual card. Touch Create a Cardfile, set your parameters, name your fields, and you can store as many as 550 cards per disk.

**The HP 150 has
softkeys that cover
most of the VisiCalc
commands.**

You can, of course, change disks and create as many other card files as you like.

The PCF is, in fact, a simple database management system. It is powerful enough to search a particular file based

on any piece or pieces of information stored within a card. In addition, the information can be transferred to Series 100/*WordStar* for form letter generation, and into the HP version of the *Condor Database Management* program.

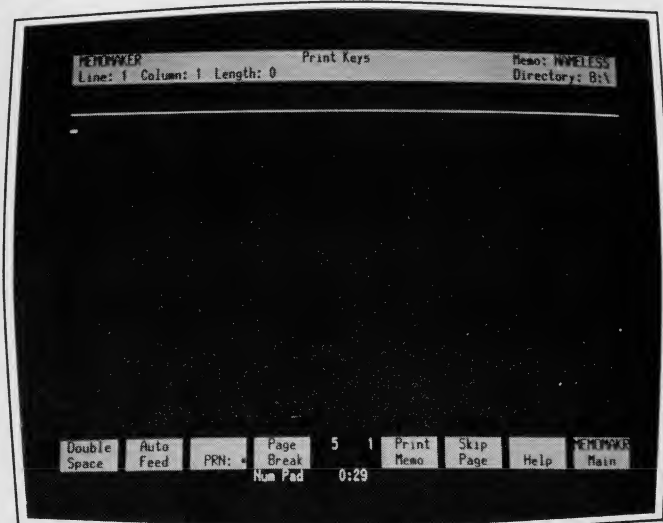
Basic

Having gotten used to touching the screen for the programs I have described, I was really looking forward to HP's version of Basic. I am not really sure what I expected—perhaps the Utopian ideal of communication with programming languages. Touch the screen—and the labels would ask me what type of program I desired and write it for me. Alas, that is the problem with Arcadian wish fulfillments; the mundane and Murphy's Law make a habit of intruding upon your flights of fancy.

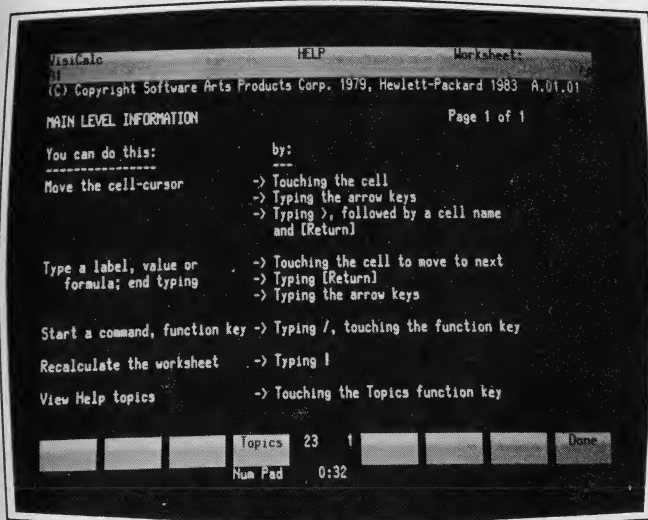
HP's Basic, Version 5.28, which costs



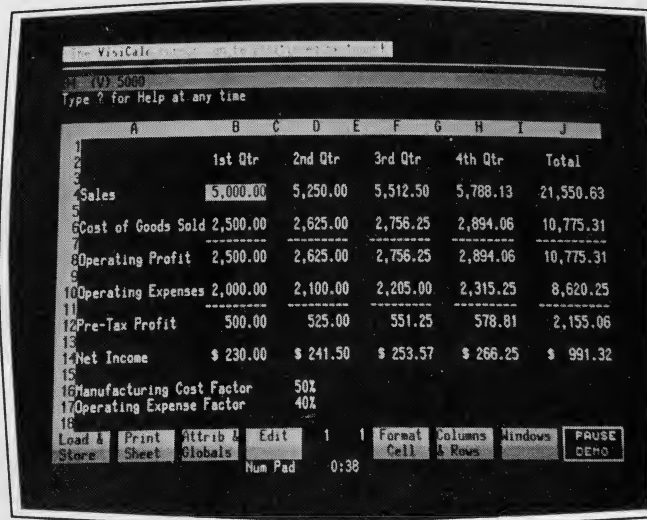
Graphics chart with softkeys.



MemoMaker Submenu Softkeys.



VisiCalc Main Level Help Menu.



VisiCalc Sample with softkeys.

\$300 is pretty standard Microsoft Basic with nary a screen label in sight. In fact, the HP manual suggests that you go out and buy a book on Basic for a better understanding and utilization of the program.

Condor

There are two versions of *Condor* available for the HP 150. Version 20-1 from Condor Computer Corp. in Ann Arbor, MI costs \$300, and version 20-3 is \$700, with an upgrade version from 20-1 to 20-3 costing \$500. Version 20-1 is the simplified version of the database program with 20-3 the full relational database system.

Both versions are a bit of a compromise for HP Touch as they use a combination of typed commands and softkey functions. ENTER, SORT, and LIST must be typed, for example, while you can touch your way through CONTINUE, REVISE, PRINT, DELETE, END, and ABORT. You can also read data in from *WordStar* and the *Personal Card File*, and read in charts from the *Series 100 Graphics* program with touch. The softkeys will make life easier for the novice, but using *Condor* to its fullest will require much more study of the manual than some of the other programs.

Graphics

HP offers three different graphics programs for the 150: HP's own *Series 100 Graphics* selling for \$300, plus two graphics packages from Computer Support Corporation, *Picture Perfect* costing \$295 and *Diagraph* priced at \$395. HP sent me their own *Series 100* package to evaluate. I will have to assume that the other two work as well.

The high resolution and the many options available through touch make this package a pleasure to use. One could, 1985 Creative Computing Buyer's Guide

and I did, play for hours putting the graphics program through its paces. You can select pen colors and shading, choose horizontal or vertical orientation, change justification and size, select colors for the plotter and a whole range of other options by touch.

You can also transfer data from *Condor* or *VisiCalc* to plot pie charts, scattergrams, bar charts, or line graphs. For those with a bent for freehand drawing, this can also be accomplished. All in

Hewlett Packard has gone to great lengths to make their documentation simple and easy to follow.

all this easy to use package is a boon for the business person who must generate charts of all types and wants to do it quickly.

Documentation

It is easy to see that Hewlett Packard has gone to great lengths to make their documentation simple and easy to follow. In the main, they have succeeded, although some of the documentation falls in the "between two stools" category. By this I mean, that in some cases I think the instruction manuals will be too much for the novice user and too little for the veteran who wants in-depth technical information.

Last Gasp

Hewlett Packard has created in the

150 a system that combines some of the best features of several other computers in one package. It is elegant in design and eloquent in its simplicity.

The touch screen is not a gimmick. It facilitates use of the most common applications of computing and optimizes the most natural way of doing it. The novice who has dragged his feet on the path to the world of computing, perhaps fearful of the expected adversarial relationship with a terminal, now has an easy starting point that leads gently to the mastery of the most formidable programs.

Knowledgeable users, too, will find the HP 150 to their liking. Hewlett Packard has provided a base of excellent programs and is actively seeking support from other vendors. The IBM emulator card will, of course, make instantly available, all the programs written for the IBM PC.

Considering what the HP 150 is and what it does, the \$3995 price tag is not out of line, although acquisition of the requisite software, printers, and plotters will bump the cost up considerably. I think it is fair to say that because of this, the HP 150 will probably not be the first choice of the individual user who wants a computer for the home. I suspect that HP's strongest market will be in the office where several users can share programs and peripherals or link their machines into a multi-user system.

Hewlett Packard has made a large commitment to the HP 150 Touch Screen, and it is as certain as anything can be these days that they will maintain it. After the hours I have spent on the system, I am convinced that it is a quality product. I look forward to further software developments from third party vendors. **END**

Kaypro 10

More Than Just a Big Screen Portable

Max A. Lebow

It used to be that a good hard disk drive would cost you more than Kaypro currently charges for its new Kaypro 10. The Kaypro 10 works like the earlier Kaypro II and Kaypro 4, the portable computers that made Kaypro's reputation. The main difference in the Kaypro 10 is the gigantic 10Mb disk drive.

Although hard disk technology has meant complicated procedures for turning the computer on and off, the Kaypro 10 has eliminated them. When you turn on the Kaypro 10 it automatically logs you onto the hard disk; before power off, you must remember to type SAFETY.

HARDWARE PROFILE

Product: Kaypro 10

Type: Portable Computer

CPU: Z80

RAM (min/max): 64K

ROM: 2K

Type of keyboard: Full-featured
72 keys, 20 programmable keys,
14 numeric keypad

Text resolution: 80 x 25

Graphics resolution: 160 x 100 pixels

Number of colors: N/A

Sound capability: N/A

Ports: 1 Centronics, 2 RS-232C
light pen connection

Dimensions: 8" x 18" x 15 1/2"

Documentation: Good

Price: Bundled system \$2795

Summary: Good value for the money.
A solid product.

Manufacturer:

Kaypro
533 Stevens Ave.
Solana Beach, CA 92075
(619) 755-1134



Although Kaypro computers are small enough to be portable, people who buy them are not necessarily interested in the portability. With the Kaypro 10, the relative vulnerability of the hard disk makes rough handling of the machine undesirable.

File Capacity and Data Handling

Think about ten telephone books each from a town of 25,000 people. That is ten megabytes of information. One way of dealing with this much storage is to divide it up into environments. The word processing environment can have all the word processing utilities and the text files. The programming environment can have the languages and the programming tools. A database environment might have the database, associated files, report generation utilities, and some word processing.

When you power up the Kaypro 10, the first thing you see after the power on message is the CP/M A > prompt. The A drive and the B drive referred to in CP/M are both resident on the hard disk. Drive C is the 400K floppy drive.

The CP/M operating system allows

you to set up different environments by assigning each environment a user number. When you are logged on as that user (no password required), the files in that environment are shown in the directory. All other files are available, but you are not reminded of that fact. The latest release of CP/M contains utilities for transferring files across user numbers, and searching for files across user numbers.

Racing Stripes

One feature that identifies all Kaypro portables is the sturdy metal case. This makes Kaypro heavier than many other portables: 31 pounds for the Kaypro 10, slightly less for the earlier models. The paint job enhances the overall appearance of the case, with the characteristic multiple "racing stripe" carried along the sides.

In use, the Kaypro 10 sits up on a built-in strut. To pack it up for carrying, it uses the keyboard housing for a base. In the position, the carrying handle on the back of the machine faces upward, ready to carry. The main computer attaches to the keyboard at the sides.

1985 Creative Computing Buyer's Guide

Connecting the Keyboard, Printer, and Modem

The keyboard is connected to the computer by a phone cord. This offers several advantages. First, connecting and disconnecting the keyboard is easy. Second, if the cord is damaged, it is easy to find another one. Third, the cord itself is relatively inexpensive, retailing for seven or eight dollars. If you are in a hurry packing up, you don't have to disconnect the keyboard, because even with the keyboard attached, the case will still close.

Two printer connectors, one serial and one Centronics parallel, are provided. Earlier Kaypros have only the Centronics parallel plug. The modem or other device attaches via an RS-232

One rock or suitcase corner in the wrong place could damage the connectors.

connector. Both connectors can be configured under the CP/M software from a menu-driven program called CONFIG. The RS-232 port is set up to handle the \$100 Signalman modem without modification to either hardware or software. The Centronics parallel port is set up so that many popular printers can be plugged in and run with no modification.

If you are going to be taking the Kaypro on trips, bear in mind that the port connectors are not protected. Although the connectors themselves are quite sturdy, one rock or suitcase corner in the wrong place could damage the connectors. Other portables, the Telcon Zorba, for example, come with at least some form of protection for the connectors.

A modular plug for a light pen is installed in the back of the Kaypro 10, adjacent to the modular plug for the keyboard cable.

Keyboard Programming Pros and Cons

Most computer keyboards come with more keys than anyone who grew up with a typewriter can comfortably use. Still it is convenient that the cursor control keys and the numerical keypad are programmable. They are not fully programmable, but they can return any designated byte value you choose. This means one programmed key can be the same as holding down the control key and another key.

The keys are personalized using the CONFIG program which is part of the CP/M system supplied with the computer. This is a menu-driven program that depicts the keys to be programmed on the screen and asks the user to supply the hexadecimal value of the byte to be returned when that key is pressed. The hexadecimal values for the ASCII characters and the control codes are available in most programming books, printer instruction manuals, and in appendix M of the MBasic manual supplied with the Kaypro 10.

It is generally agreed that a keyboard should make some sound when you press a key. This gives you some feedback; it tells you the keystroke has been duly registered. This little key click saves you the trouble of looking at the screen all the time to make sure you have not dropped a letter. This is more important in offices than for home users. In fact, home users may want to work near people—children, parents, spouses, in-laws—for whom the key click may be very irritating.

Although the key click on Kaypro keyboards sounds like an expiring cricket, fortunately it is software selectable. You can turn it off if your spouse asks you to. Either an OUT 5, 8 command line issued from MBasic or a command file created from SBasic (both of which come with the Kaypro), will turn off the click.

The Big Screen

Big screen medium-resolution monochrome graphics (100 by 160 pixels) are available on the Kaypro 10, unlike the earlier Kaypro II and 4. Graphics are accessible from MBasic. Special extensions to SBasic and sample subroutines in SBasic are included with the Kaypro 10 to make it easier for programmers to develop graphics applications. The hardware and software that drive the Kaypro 10 screen support blinking text, reduced intensity, inverse video, and cursor on/off.

Two graphics characters, a solid block and a patterned block, allow some "make-do" graphics on the Kaypro II and 4. Some of the games that come with the Kaypro use cleverly arranged letters and numbers to form graphic-like patterns for games. Aliens, for example, plays like Space Invaders.

Higher resolution color graphics boards are available for the Kaypro II and 4 as a retrofit. I have seen a wire wrap version of one of these running on a monochrome monitor, and it looked like about 256 by 512 pixels. Frankly, if you want fast, spectacular graphics, pick another machine.

One of the biggest issues among users of portables is screen size and legibility. Early portables designed for news re-

porting often had tiny screens that could not be read for long without eyestrain. This tradition was carried over to the Osborne 1, which has a 5" diagonal screen, displaying about 50 characters per line. The Kaypro has a 9" screen and fits 80 characters on a line. The Osborne Executive has a 7" screen.

One might be tempted to say that Andy Kay, the inventor of the Kaypro, made his screen bigger when he learned about user resistance to the Osborne screen. However, according to Peter McWilliams, who wrote *Personal Computer Book*, Kay had been planning the Kaypro—as a portable engineering tool—for months before the Osborne came out.

What you see on the screen are green, upper- and lowercase letters. Letters are drawn from the character generation ROM and are a maximum of five dots wide by seven dots high. Letters that normally extend below the line, actually extend below the line when you see them on the screen. Although in earlier Kaypros these descenders tended not to be as tall as the letters that did not descend below the line—for example, the lowercase m was taller than the lowercase g. This curiosity has been remedied in the Kaypro 10.

Math buffs will be happy to know that a Greek character set is accessible by

The best news about the MBasic that comes with the Kaypro is that it allows variable names longer than two characters and a type identifier.

sending an ESC-G from the keyboard or PRINT CHR\$(27); CHR\$(71) from Basic. Lowercase letters are then displayed in Greek. Sending ESC-A or PRINT CHR\$(27); CHR\$(65) restores the normal lowercase display.

Software, Software, Software

The Kaypro 10 comes bundled with roughly \$2200 worth of software, including *WordStar*, *The Word Plus*, *MicroPlan*, *Super Term*, *MailMerge*, *InfoStar*, *CalcStar*, and *dBase II* with a tutorial.

In addition to the applications programs, the Kaypro 10 comes with Microsoft's MBasic and a compiler Basic called S-Basic from Topaz Programming. CP/M 2.2 is also included.

For those who struggled with Radio

Shack's Level I and Level II Basic languages, the best news about the MBasic that comes with the Kaypro is that it allows variable names longer than two characters and a type identifier. Other handy features for programmers include a command for renumbering program lines or ranges of lines, a function definition facility, and random access disk commands.

CP/M 2.2 for the Kaypro 10 comes with the required hard disk BIOS, and in fact the system initializes to user 0 on the hard disk on power up. A directory management facility, D, helps users find

files by alphabetizing directory display, displaying information on file attributes without using the STAT command, for example.

To accommodate the serial printer port, the CONFIG program has been expanded to allow the user to specify which printer port will be used with a given word processing program. Another accommodation for the additional serial port is the inclusion in the system software of two BAUD programs. BAUDM sets the baud rate on the modem port, and BAUDP sets the baud rate on the printer port.

Terminal emulation software—the Kaypro 10 can emulate an ADM3 terminal—is provided with all the other software. This program, TERM, does enough to get you started on the Source or CompuServe, but it does not support file transfers. Also, under TERM the Kaypro locks up when you go into the terminal communications mode, if no modem is attached, requiring that the system be cold booted. This admittedly minor inconvenience contrasts with the automatic warm boot that occurs when trying to print using the PIP LST:= command. The standard CP/M utilities, DDT and ASM, are included.

A very important command is included in the Kaypro 10 system software. SAFETY moves the read/write heads on the hard disk to the safe landing zone on the disk. This must be done before turning the power off or the surface of the hard disk may be damaged. The SAFETY command is invoked from the command mode in CP/M.

Documentation


Three large paperbound books document MBasic, SBasic, and CP/M. A 100-page ring binder introduces the user to the Kaypro 10. This volume replaces the smaller, spiral-bound book that introduced users to the Kaypro II and 4. This volume also introduces the major software programs.

Kaypro has tailored the software documentation to the Kaypro, and the manuals are spiral and paperbound rather than contained in loose-leaf binders. A pocket guide for MBasic rounds out the documentation set.

Documentation for MBasic and CP/M seems to have been collected and photocopied from various documents and listed from disk files and photocopied, rather than typeset. The CP/M documentation is in separate sections that appear to have been self contained at one time. One of the many introductions to CP/M now in the book stores would be a wise investment for anyone new to both CP/M and the Kaypro.

In Summary

The overriding impression of this machine is of quick and inexhaustible storage and retrieval capacity. The screen will do, and the keyboard is rugged and reliable. About the only serious limitation is the 8-bit microprocessor. For the near term, there is still more software for 8-bit machines than for the emerging 16-bit machines.

Color graphics would be nice if this were a game machine, but it is not a game machine. It is designed for business, and even the portability, although attractive, is less important than the unbeatable cost/performance ratio. 

CIRCLE 490 ON READER SERVICE CARD

What do you get when you cross 1200 baud, free on-line time, and extra features at a price Hayes can't match?

Data Rate?

The MultiModem gives you a choice—either 1200 or 300 bits per second. So you can go on-line with the information utilities. Check out bulletin boards. Dial into corporate mainframes. Swap files with friends.

On-Line Time?

With the MultiModem you get CompuServe's DemoPak, a free two-hour demonstration of their service, and up to seven more free hours if you subscribe. You also get a \$50 credit towards NewsNet's business newsletter service.

Features & Price?

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CIRCLE 111 ON READER SERVICE CARD



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Now, translate your integrated software into integrated hard copy, with the TI OMNI 800™ Model 855 printer. So versatile, it combines letter-quality print, draft-quality print and graphics as no other printer can. It prints letter-quality twice as fast as comparably priced daisy wheel printers, yet gives you characters just as sharp, just as clear.

It prints rough drafts ten times faster than daisy wheel printers... faster than most any other dot matrix printer. Only the TI 855 has snap-in font modules. Just touch a button; change your typestyle. The 855 gives you more typestyles to choose from than ordinary dot matrix printers. It makes them quicker, cleaner, easier

to access than any other dot matrix or daisy wheel printer.

The 855's pie charts are rounder... all its graphics are sharper than on other dot matrix printers, because the TI 855 prints more dots per inch. As for daisy wheel printers... no graphics.

The TI 855 Printer

The printer for all major PC's



For under \$1,000 you get twice the performance of typical dot matrix printers. Or all the performance of a daisy wheel printer, and then some, for half the price.

So get the best of all printers, and get optimum results from your integrated software. With the TI 855. See it at your nearest authorized TI dealer. Or call toll-free: 1-800-527-3500. Or write Texas Instruments Incorporated, P.O. Box 402430, Dept. DPF-182CC, Dallas, Texas 75240.

TEXAS INSTRUMENTS 
Creating useful products
and services for you.

ACT Apricot

A Good Look At The Future

John J. Anderson

The British are most definitely coming. Over the course of the past three years, we have reported as much. Machines such as the BBC educational micro are destined to have an impact not only in the United Kingdom, but worldwide.

This very much includes the "States," as the Brits call us. While we have managed to maintain a technological lead, the British have had something of an edge on the U.S., at the least in their acceptance and interest in microcomputing for the last couple of years. That has lately translated into a design edge and has now begun to show in a new generation of innovative entries that compete quite well with American machines. And nowhere is that edge more evident than in the Apricot from ACT.

Before we get into trouble with some of our friends across the sea, let us clarify: ACT (for Applied Computer Techniques) is headquartered in Birmingham, England, does its research and development at Dudley in the Midlands, but manufactures computers in Scotland. So perhaps English would be a better term than British to use in describing ACT.

ACT is the distributor of the Victor 9000, a machine that has had a limited impact on our shores, but has become quite popular in the U.K. and on the Continent as the Sirius 1.

The Apricot is not just another fruit. Its mass of features makes it a sure thing



The Apricot is not just another fruit.

HARDWARE PROFILE

Name: ACT Apricot

Type: Transportable business system

CPU: 16-bit 8086 5MHz

RAM: 256K, expandable to 768K.

Keyboard: 96 keys, full-stroke, fully programmable

Text Resolution: 80 x 24

Graphics Resolution: 800 x 400 pixels.

Color/sound: Monochrome/TI 76489 sound chip, large built-in speaker.

Ports: RS-232 serial, Centronics parallel.

to put a dent in the jaded U.S. market. At \$2895, it sports a true 16-bit 8086 processor, clocked at 5MHz, and 256K standard RAM, expandable to a whopping 768K. It makes use of dual state-of-the-art Sony 3½" microfloppy drives. It runs MS-DOS 2.0, CP/M-86, and

Dimensions: CPU 17" x 12" x 5";
CRT 11" x 10" x 9";

Keyboard: 16" x 7" x 2"

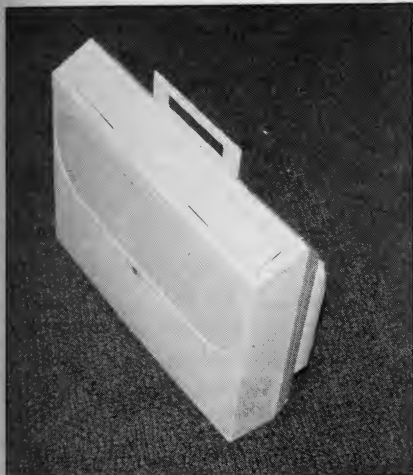
Documentation: Excellent. Five manuals.

Price: \$2895 with dual, single-density drives.

Summary: An innovative, high quality machine, setting a new standard in the "transportable" category. LCD microscreen capability is novel and useful.

Manufacturer:

ACT (North America) Inc.
3375 Scott Blvd., Suite 342
Santa Clara, CA 95051
(408) 727-8090



The Apricot in attaché mode.

Concurrent CP/M-86.

Its keyboard is unmatched by any machine on the market today. It includes a ground-breaking 40-character two-line LCD display, which can define a row of special function keys below it, or be used independently. The keyboard also features a battery-powered internal clock/calendar, the contents of which read out on the LCD but can also be piped to the CPU under MS-DOS. On deck for the unit is an add-on internal autodial modem, and co-processor capability.

Now picture this: all of these features are packed into a case no bigger than an attache. Unpacked, the unit CPU case measures 17" x 12" x 5". Its CRT, with pedestal, measures in at 11" x 10" x 9", and when seated in place above the main box, brings the total height to only 15". The tapered, detachable keyboard, which clicks solidly into the bottom of the main case for transport, measures 16" x 7" x 2" at its widest points. Pull out the hidden handle, push down the handsome shutter that protects the microdrives, and you're ready to shove off. The packed system weighs 17½ lbs. in one hand, with the CRT 9 lbs. in the other.

The Apricot is not labeled a portable but rather a "transportable," as the CRT for the unit is external, and you must be near a power socket (mains, as the British say) to use the computer. Still, you are getting a full-size display in the trade-off, and for our money it is much easier to carry a packed-up Apricot with CRT than to lug around a Kaypro or Compaq—and certainly more desirable.

Cosmetically, the Apricot is just about the best looking micro you are apt to see. At least two members of our art department stopped dead in their tracks when they saw the thing, and said "wow." The Apricot is a knockout. It looks exactly the way a next-generation microcomputer ought to look, and then some. Everything about it signals "quality."

1985 Creative Computing Buyer's Guide

And its beauty is far more than skin deep, as you shall see.

The Keyboard

One look at the detached keyboard and you know you are on to something special. It has 96 fully programmable keys, and is laid out in the IBM-Selectric style. It includes dedicated HELP, UNDO, PRINT, MENU, and FINISH keys to make life easier although each and every key on the keyboard can be easily redefined. The CAPS LOCK and STOP keys are LED illuminated to indicate their activation. There is a full numeric keypad and nearly directional cursor movement keys (see photo). The angle of the keyboard is not adjustable, but seems to be set at a very acceptable rake.

The "feel" of the keyboard is excellent. It has a tight but full-travel action and no bounce whatsoever. At first we felt the keyboard was a bit spongy,

One look at the detached keyboard and you know you are on to something special.

but we were pressing too hard. Upon letting up a bit, we realized the keyboard design accounts for all tastes. There is no feeling of having "hit bottom" during a keypress, so angry typists can vent their frustrations without spraining fingers. Hence the feeling of sponginess. At the same time, feather-touch typists will notice the keyboard response is fantastically swift. By the time the key has traveled a millimeter or so, the keypress has registered.

The autorepeat start time, repeat rate, and keyclick volume of the keyboard can be simply controlled through software. More about that up ahead.

Then there is the "microscreen." This is a two-line, 40-character LCD display on the upper righthand side of the keyboard. Upon power-up, it displays the date and time (see photo). It is also used to label six touch-sensitive function keys just below it. Each function key has its own LED, to indicate when it is activated. One very nice use of this feature is the ability to redefine these key labels throughout the levels of a program. The keys can change function without muss or fuss, and remain clearly labeled at all times. It takes more pressure to activate the touch-sensitive keys, but this is perhaps a desirable feature for the special function keys—they cannot be accidentally invoked.

Another feature of the microscreen is the calculator mode. Press the CALC key in the top row of permanently assigned function keys, and the LCD becomes a full-blown calculator with memory. You may perform all the operations you desire, then return to whatever spot you were in before you entered the calculator. You can even send the results to the current program. There is a percent key, too, which is very handy.

As on the TRS-80 Model 100, the angle of the LCD can be adjusted with a thumbwheel on the righthand side of the keyboard. This ensures that the display will be legible from any conceivable posture. Next to the thumbwheel is a recessed reset button. To prevent accidents, it must be held in the depressed position for one full second before the Apricot resets.

When the unit is on and the keyboard is plugged in, the LED dot on the "i" of the Apricot logo is illuminated—very stylish.

On the rear of the keyboard is a mysterious DB-9 jack, which will soon add mouse capability to the Apricot as well. With its LCD-defined function keys, the need for a mouse is questionable, but thoughtfully, ACT has put the capability there anyway.



The best keyboard we've ever seen or touched.

The Disk Drives

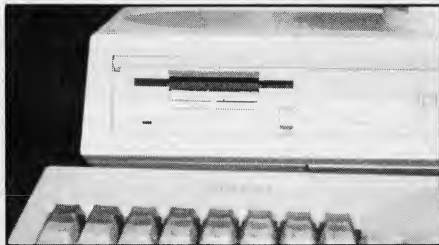
When a company goes OEM for drives, it has to keep quality and availability in mind. To go OEM for a new technology, such as microdrives, the criteria become even more critical. For ACT, the decision was obvious: the Sony microdrive. Proven performance, proven reliability, and proven availability are hallmarks of the Sony name. The new Sony 3½" drives are a look at the future of disk storage. The drives supplied with the unit we tested in the lab were single-sided, limiting storage to a mere 315K per drive. On deck for the Apricot, are new double-sided drives, which will more than double this capacity, bringing the total disk storage capacity to well over 1Mb.

The Sony drives are a joy. They are noiseless but for a click when activated and are very, very fast. We watched full-blown hi-res screens load from disk in

The Sony drives are a joy. They are noiseless but for a click when activated and are very, very fast.

under five seconds. Spring-loaded metal shutters in the disks protect head access holes from wandering thumbprints, and as a recent innovation, are automatically opened and reclosed within the drive. The user need never (and should never) see the magnetic medium itself. There is no need for doors on the drives, and the disks themselves can take a great deal of abuse.

Also in the on deck circle from ACT is a 3½" hard disk option, which will fit in place of drive B. If the 10Mb offered



Doorless microdrive.

by this option is still not enough for you, you will have to look to external storage methods.

The CPU and Environs

The computer inside the main case of Apricot is on a single board, maximizing reliability and ease of service when it is

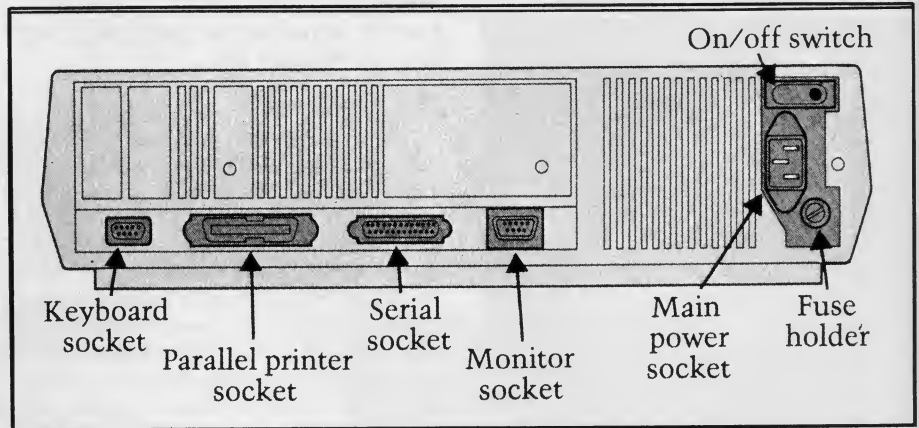


Figure 1. The rear end.

needed. Built around the 8086 CPU, a separate 8089 input/output processor handles I/O operations to and from the drives and the asynchronous link. Room for an optional 8087 mathematics processor is also available on the board, although use of this add-on chip will require software written specially for it.

The 8086 CPU is a twin to the 8088, but has a true 16-bit bus, as opposed to the 8-bit data bus of the 8088, as found in the IBM PC. This speeds its benchmark, as shown up ahead. The advantage of the 16-bit software approach has yet to surface, but we remain patient. If and when it does, the Apricot will exhibit it.

For the purpose of comparison, we ran the David H. Ahl Quickie Benchmark Test on the Apricot, as a measure of CPU speed and accuracy from Basic (for a full description of the test, see the November issue of *Creative Computing*). The Apricot scored in the top five machines tested as of this writing: the answer came back in 17.6 seconds, with an accuracy of 0.005859375, and a sum random of 7.18416. Like EPA mileage statistics, the benchmark should be taken with a grain of salt. Still, the Apricot outperformed many of its more-touted rivals. For example, the IBM PC took 24 seconds in the same test, returning an accuracy of only 0.01159668.

Also on the CPU board are two expansion slots. Whether these are going to be enough for the serious user remains to be seen. One will be taken in nearly all cases by the modem card. The other will in all probability have to lead to an external expansion box, if the user desires the full 768K RAM and co-processor or IEEE-488 capability. Third party hardware manufacturers take note: the expansion slots are fully documented and just waiting for Apricot-compatible goodies.

At the rear of the unit are sockets for the power cable, keyboard, and monitor (see Figure 1). In addition there are a Centronics parallel printer port and an

RS-232 serial port. The keyboard input uses a male DB-9 plug, while the monitor uses a female DB-9 socket, so there is no way to hook up incorrectly. The parallel port uses exactly the same jack

The CRT for the Apricot is one of the sleekest we have ever seen.

as those found on Centronics parallel printers themselves—this is quickly becoming the de facto standard configuration. The RS-232 plug is the standard DB-25 male. These configurations make hooking up the Apricot to external devices as straightforward as possible.

The Display

The CRT for the Apricot is one of the sleekest we have ever seen. It tilts and swivels, and can be moved across the width of a shallow groove in the top of the main box. This allows the display to be positioned extremely flexibly.

Although the display is only 9" measured diagonally, it provides crisp, clear, easy-to-read characters and very serviceable hi-res capability. It has a non-reflective green-screen coating, and a resolution of up to 800 x 400 pixels. The only necessary external control is a brightness knob.

As far as we are concerned, the CRT arrangement of the Apricot is much preferable to an internal monitor of smaller size, such as is found on the Kaypro. An indented handle makes carrying the CRT as convenient as possible, though in most cases it would probably be boxed for transport. Another possibility would be to have a CRT at each location the Apricot is to be used, such as at work and at home. Then the Apricot, sans CRT, would

truly qualify as a portable.

The custom CRT plugs only into the Apricot, from which it receives not only a video signal but its power supply. This makes cabling a breeze, but pre-empts the possibility of hook-up to conventional, and less expensive, monitors. Extra Apricot CRTs cost about \$300 each.

Modus Operandi

The decision to supply fully three operating systems with the Apricot is another good example of ACT's savvy in positioning its machine, and should not be overlooked when assessing the total cost of the system. The flexibility of the Apricot is unbeatable on this score: the user may choose CP/M-86, Concurrent CP/M-86, or MS-DOS 2.0 to operate the machine. Each system has its own advantages, and the ability to pick and choose between them allows the user to skirt the disadvantages of each.

Digital Research CP/M-86 is a fine operating system, proven over time and offering a vast array of software. Concurrent CP/M-86, also from Digital Research, enhances the versatility of plain old CP/M-86, and offers the capability of multi-tasking, wherein more than one program may be executed simultaneously.

Using Concurrent CP/M-86, you can create up to four "virtual consoles." These are channels that you can switch between, just like channels on a TV. You may perform word processing on channel 0, while running a spreadsheet on channel 1, a database on channel 2, and a telecommunications program on channel 3. Multi-tasking is necessarily memory intensive and, therefore, most powerful under the maximum RAM configuration.

In the buffered mode, characters generated within a running program are saved to a temporary disk file during switching between consoles. When you return to the original console, the saved file is re-established within it. In this manner you may let one program turn out pages of text while you work on another project, then return to see how the first program is doing whenever you like.

Concurrent CP/M-86 also supports passwords, user numbers, and file attributes, which are not supported by CP/M-86. Additionally, Apricot Concurrent supports date- and time-stamping of files from the internal clock/calendar, and several other commands which combine to make CP/M-86 more powerful and easier to use. There is even a windowing capability a la Lisa, but we must be careful about comparing Apples with Apricots.

Then there is MS-DOS 2.0, which offers some very provocative potentials.

First off, and very importantly, it is fully compatible with MS-DOS as it appears on the IBM-PC: using the serial port and telecommunications drivers on each end, programs can be downloaded directly from the PC. Then, using a supplied IBM emulator program, they can be run on the Apricot (let us pause to reflect that commission of such transmission might infringe on copyright laws). In the U.S. later this year we may see a 5 $\frac{1}{4}$ " outboard add-on disk drive that reads IBM disks. We have stressed to ACT the advisability of such a peripheral, at least on this side of the Atlantic.

The Manager

But there is much more than IBM-compatibility to the advantage of Apricot MS-DOS as an operating system. Foremost of these is the Manager, a beautifully designed user interface program that makes working with the Apri-

You may wish to bypass the Manager shell and interact directly with MS-DOS.

cot easy for even the utter novice. If you so desire, you need never face MS-DOS to use it—just use the Manager to get where you are going.

Upon power-up, the Apricot runs a self-test, the microscreen reads out date and time, and the CRT indicates readiness for insertion of a disk. When you insert the system master, the Manager module autoruns. It provides a handsome and easy-to-use menu of the programs available. The microscreen function keys will be activated, making selection of the desired program as simple as a single, clearly labeled keystroke. Alternatively, you can use the cursor keys to move through the menu, then hit the RETURN key when your choice is highlighted. And if you had a mouse, you could use it to choose your selection.

As you move the cursor horizontally through the five possible "ladders" of the menu, that bank of choices automatically appears on the microscreen, and the function keys automatically toggle to reflect the new set of choices. At the same time, a brief help note describing the nature of each program appears at the bottom of the main display as its name is highlighted.

If more detailed helps are needed, they are available all along the way. Help can be chosen from the lefthand ladder at any menu point along a decision-tree, or the HELP key itself can be

pressed. In this way more information can be called up without (horrors!) reference to documentation.

Backing out of any selection along the trees and subtrees of the Manager returns you to the previous step. Although this can become tedious during complex operations, it ensures that you will never lose track of just where you are. The Manager has an index which can hold up to 29 programs plus the Tools program, which allows for easy execution of housekeeping chores.

The programs you wish to hold in an index must be assigned using one of the utilities of the toolkit, along with a single sentence help description you provide. Adding, deleting, or changing the index of the Manager, is extremely simple, using the OPTION utility.

If an attempt is made to execute a program that is in the index but not on the same disk as the Manager a prompt asks you to insert the correct disk. Then press the spacebar, and if present, the desired program will load.

You may wish to bypass the Manager shell and interact directly with MS-DOS. Simply choose the FINISH option from the main menu, and the all-too-familiar >A prompt comes right up on the screen. Purists relax: the Manager in no way obscures MS-DOS from those who choose to access it directly. We can't imagine, however, even the most seasoned user rejecting the convenience of the Manager program for routine access to the powers of the Apricot.

Other Configurator utilities available from the Tool module or directly from MS-DOS are the following:

- Disk, which allows the setting up and erasure of directories and supported subdirectories; copying, renaming, verifying, and deletion of files, formatting and back-up of disks.

- Alter, which allows on-the-fly configuration of the serial port, on-the-fly selection of serial and parallel output, and setting the date and time on the clock.

- Tailor, which allows for the editing and entry of foreign characters and special fonts, programming of the keyboard, entry of a custom logo to replace the "Apricot" banner on the upper right-hand side of the main display, and modification of the Manager.

- Setup, which allows keyclick and bell volume adjustment, keypress auto-repeat and delay-rate adjustment, customization of LCD default display, and customization of system defaults.

- Miscreen, which allows the microscreen to be programmed.

- Spooler, which allows files to be queued to a printer while the Apricot moves on to another task.

Special fonts, logos, keyboard configu-

rations, disk and overall system defaults may all be saved as disk files and retrieved when and where necessary. Most of the programs for creating these use ladder-based menus as does the Manager, and are quite painless to use. The font, logo, and keyboard editors, for example, are totally self-prompting, and make customization much easier than on any other system we have seen. Settings of keyclick and bell are aided by barcharts graphing volume. Everywhere, it seems, care has been exercised to make Apricot housekeeping as easy as possible on the user.

This capability comes at a price, however. When MS-DOS is invoked on a 256K system, free RAM memory is chopped in half to 128K. A 48K chunk of RAM is, however, enclosed in the BIOS (Basic Input/Output Section) to hold special fonts, bit-mapped screen RAM, or even act as a file buffer—like a

**The folks at ACT
acknowledge that the
choice of a word
processor is an
extremely personal
one.**

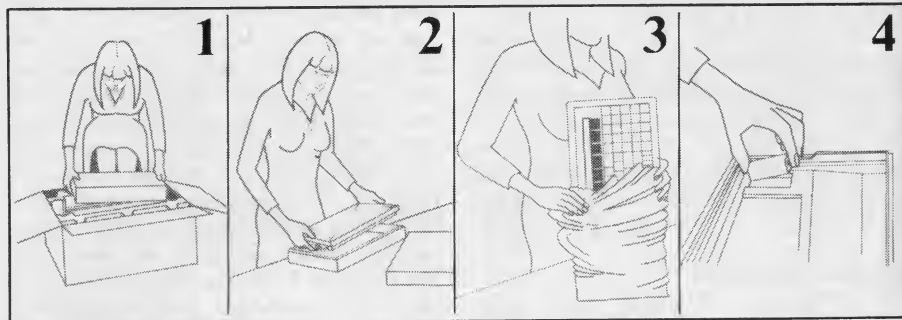
miniature RAM-disk. As programmers learn to use this feature, it will become more significant.

So don't hold your breath for Concurrent Apricot MS-DOS—we guess you would need 512K just to get off the ground with such an option. You are free to dream, however. And from what we have seen already, who knows *what* these folks are capable of.

Bundled Software

For the base sticker price of the Apricot, these three operating systems might have been enough, but ACT has not stopped there. On the disks supplied with the unit (in a cute snap-pocket case), you also get the GSX Graphics System from Digital Research, which allows transportability of graphics standards across CP/M, Concurrent, and, believe it or not, MS-DOS. You get two versions of Basic, from Microsoft and Digital Research (the DR package, called Personal Basic, was not available at the time of this evaluation). You get *SuperCalc* and *SuperPlanner*, from Sorcim, which are the familiar spreadsheet package and a new address book/calendar planning package, respectively.

Originally, the folks at ACT chose not to bundle a word processor with the Apricot, acknowledging that the choice



Please keep your seatbelt fastened during unpacking.

of a word processor is a personal one. However, now *Superwriter*, from Sorcim, is bundled in the base sticker price.

ACT has announced that it will be releasing a bevy of business software, initially from its Pulsar line, in Apricot microflop format. It has announced Fortran, Pascal, and a Macro86 assembler. We took a quick look at run-time Cobol, and like *WordStar*, it did run. What more can you say about Cobol?

Anyone with access to a Victor 9000 or Sirius computer should know that the Apricot is Sirius-compatible as well, via the asynchronous port. Software downloaded in this manner will run without any problem. The only ramifications to the process are legal, not technical.

The Documentation

The documentation accompanying the Apricot is superlative. It consists of five manuals: an Owner's Handbook, with general instructions and an introduction to the Manager; a Configurator Guide, documenting the many utility programs available; a CP/M and Concurrent User's guide; an MS-DOS User's Guide; and a *SuperCalc/SuperPlanner* manual.

The operating system manuals are based on the original documentation from Digital Research and Microsoft, and are quite readable. The MS-DOS guide is indexed, while the CP/M guide is not. The owner's handbook is a very general introduction, designed to prime the user without intimidation for what is to come. It is nicely indexed and includes a very helpful glossary. The Configurator Guide is one of the most important pieces of documentation in the package, and is quite clear, though unindexed, and a bit terse at times. The *SuperCalc/SuperPlanner* manual we received had no documentation concerning *SuperPlanner*—just a page outlining the functional structure of the program, and indicating that "information about this product is currently under production." We trust this will be remedied by the time you read this.

In total, the job documenting this new machine has been exceptional. Though it is generally accepted that English English and American English are two dif-

ferent languages, the documentation has not been rewritten for its U.S. debut, and save for minor problems, it does not suffer for it. An example of the severity of the situation: "If you think of Basic as a 'family saloon' programming language, then C is a 'sports car' language." A family saloon? Not even in Dodge City, guys. Full stop.

**The Apricot was an
open-and-shut case of
love at first sight—and
lasting, true love upon
further inspection.**

One of the biggest kicks we got out of the documentation was the international unpacking instruction card. It is an oversized fold-out pictorial and has been drawn by the same person who draws the escape instructions for passenger airplanes. It breaks the Apricot unpacking procedure into 15 easy steps, not counting inflation of your life jacket. For all its amusement, it does provide a guide for the petrified. Next to having your machine unpacked by a stewardess, it is unparalleled in its helpfulness.

The Bottom Line

The Apricot was an open-and-shut case of love at first sight—and lasting, true love upon further inspection. From the outset, however, we felt it was a bit pricey. At \$2895, other options may beckon, clouding the issue. After thoroughly putting it through its paces, however, we changed our tune. The Apricot offers a great deal of value for the cost, considering the quality of its keyboard, drives, CRT, circuit design, and bundled software. It is truly a gem of a system.

Still, if it were to come down a thousand dollars or so, it might do more than just enchant us, and give us a good look at the future of the transportable market. It might just turn the whole U.S. micro market on its ear. We're keeping our fingers crossed.

Four New Computers From ACT

David H. Ahl

In one of the most dramatic new product introductions on either side of the Atlantic, ACT recently unveiled four new Apricot computers, thus making the Apricot line one of the most complete from any manufacturer.

Prior to the launch, ACT distributors were flown up to the ACT plant in the new town of Glenrothes, Scotland. This particular area of Scotland—from northeast of Edinburgh running west along the Firth of Forth—has come to be known as Silicon Glen, and is the home for much of the U.K.'s computer industry. As a result, a highly skilled and motivated labor force has gravitated to the area, much as has happened in the San Francisco Bay area.

The year-old ACT plant is a model of efficiency, and, although it is not as highly automated as some Japanese and American factories, quality control is second to none. In contrast to Far Eastern factories, the work floor is open, airy, and relatively quiet. As the government requires a certain amount of space per worker, even after gearing up to make the new machines, the plant should retain its nonclaustrophobic atmosphere.

ACT Concert in Royal Albert Hall

No, it wasn't the Proms—an extremely popular classical concert series held toward the end of the summer—but more than a few Londoners wondered just what was going on at Royal Albert Hall on June 28th. ACT called it "the most remarkable event in the history of the British micro-computer industry," and perhaps it was. More than 2500 U.K. computer dealers, international distributors, and members of the press were present at 12:00 noon for an extravaganza of light and sound, dancing girls, comedians, a midget, and, oh yes, four new computers.

Since you are not reading this magazine to learn about multimedia shows and champagne lunches, let's talk computers. Perhaps the most significant aspect of the launch is the fact that ACT now offers a complete, upward-compatible line of 16-bit computers and is, as far as we know, the only manufacturer in the world



to do so (see table). The only significant parts of the market in which ACT does not have an entry are the home and notebook portable segments. And if you believe Roger Foster, managing director of ACT, ignoring these sectors is quite deliberate.

The significance of having a complete family cannot be overemphasized. Besides providing buyers with some very attractive machines to consider, a compatible line makes the initial decision as to which computer to buy much less critical. You can select the machine that is best for your school or business today secure in the knowledge that as your requirements increase, so can your Apricot expand.

F1 Entry Level Business System

The Apricot F1 has a 16-bit 8086 micro-processor running at 4.77 MHz (as does the entire Apricot line), 256K of RAM (expandable to 768K), double-sided, 3½" floppy disk drive (Sony type) with 720K of storage, a cordless infra-red full-stroke keyboard, color graphics, and RS-232 and Centronics interface ports.

The keyboard is a European-style unit with square keys having a rounded depression in the top of each one. One can get used to it in a few hours. The unit is a longish 17.7" x 8.7" wide. It has 92 keys

with a numeric keypad and ten function keys at the right side.

In addition to the keyboard, ACT also offers a wireless mouse (a mouse without a tail?). Moreover, the mouse can be used upside down as a trackball which, if your desk is as cluttered as mine, could be a considerable plus. The mouse has two buttons, one on each side, and is fully compatible with the Microsoft mouse.

The system unit houses the electronics and single disk drive. This compact unit has a single expansion slot which most likely would be used for memory. In addition, an external expansion box with five more slots is available; this box can also hold a second 3½" drive or a 5¼" one.

The F1 drives practically any kind of display: RGB monitor, composite video monitor, or standard TV set. Graphics resolution is 640 x 256 pixels (four colors) or 320 x 256 pixels (16 colors). Resolution on U.S. NTSC displays will be 640 x 200 and 320 x 200. Text resolution is the expected 80 characters by 25 lines.

To increase system performance, the F1 basic input/output system (BIOS) has been implemented in 32K of ROM. The BIOS handles communication with all devices connected to the computer, and

putting it in ROM reduces the amount of space required by the operating system, which leaves more memory for applications software and user programs.

The bundled software with the F1 includes the MS-DOS operating system; Sorcim *SuperCalc*, *SuperWriter*, and *SuperPlanner*; ACT *Diary*; ACT *Sketch* (an easy-to-use drawing tool with a wide range of handy features); the *Apricot Tutorial*; and even a challenging strategy game. Many of the software packages make extensive use of icon and window technology and can be accessed by either the keyboard or the mouse.

For multi-user applications, Concurrent DOS (formerly Concurrent CP/M) is also available. Other optional packages include CP/M-86, GW Basic, Personal Basic, GSX graphics system, and Dr. Logo.

F1e Education System

The F1e education system is a cut-down version of the F1. Although it is aimed at the education market, frankly we don't see any reason at all that this wouldn't have appeal for the serious home user as well.

Physically, the system appears identical to the F1. However, it has only 128K of RAM and a single-sided disk drive (315K of storage); everything else is the same as the F1 in the hardware.

The software bundled with the F1e includes CP/M-86, Personal Basic, and Dr. Logo.

The F1e can be upgraded into an F1 with a "Business Upgrade Kit" which includes additional memory, an expansion box, MS-DOS, and business software packages.

State-of-the-Art Portable

An interesting half step up and half step to the side from the F1 is the *Apricot Portable*. Weighing less than 13 pounds, the *Portable* features a full-size 80 x 25 character (640 x 256 pixels) flat screen LCD display, cordless keyboard and mouse, and built-in speech recognition unit. Other hardware specifications are the same as the F1. Incidentally, the machine does not run on batteries.

Technologically, the speech recognition unit is probably the most interesting. It is manufactured by Dragon Systems of West Newton, MA and uses a microphone cradled on the right of the display. It can have a vocabulary of 4096 words of which 32 can be active at a time. ACT furnishes voice-driven versions of ACT *Diary* and ACT *Sketch* with the computer. It is uncanny to speak to the computer with a phrase such as "Print all appointments starting after 1:00 p.m. next Monday" and see an appointment list appear on the screen. The *Diary* package itself is quite amazing with separate windows for a calendar, appointment schedule, and detailed

descriptions of individual appointments.

The 25 line by 80 character LCD screen is made by Sharp. Although several manufacturers have talked about the product, only ACT and Apple (for the IIc) have actually announced its availability. Interestingly, the LCD screen can be used simultaneously with a color (or monochrome) monitor. With this combination, it is possible to run two applications on the two screens simultaneously using the windowing software. Or, when using a package like *SuperCalc 3*, text can be shown on the LCD screen while graphics are displayed on the color monitor.

The LCD screen is supported by a separate 16K memory module and a custom IC. With the LCD screen on, the color screen can display 640 x 256 pixel graphics in eight colors; with the LCD screen off, 16 colors can be displayed.

In common with the F1, the *Portable* has an expansion slot for additional memory, and it may also be upgraded with a 10Mb Winchester hard disk.

Apricot and Apricot Xi

The *Apricot* and *Apricot Xi* (hard disk version) computers are unchanged from the originals (see *Creative Computing*, Feb. 1984 for a complete review). They are furnished with 256K; a 96-key full-stroke keyboard with a two-line, 40-character LCD display; internal battery-powered clock/calendar; TI sound chip; serial and parallel ports; dual 3½" Sony disk drives; high-resolution monochrome display; and MS-DOS.

We were especially impressed with the *Manager* overlay on the operating system which makes using the *Apricot* a joy for a novice as well as an experienced user. The system also includes the same excellent range of bundled software packages as the F1. Concurrent with the ACT announcement of the new computers, Lotus Development Corp. announced that *Symphony* would be available for the *Apricot*. *Symphony* is an integrated package including spreadsheet, database, word processing, and graphics software.

Point 7 Clustered System

The *Apricot Point 7* is an upward extension to the existing *Apricot Xi*. It includes 512K of RAM, a 10Mb Winchester hard disk, a double-sided 3½" floppy disk, and a six-terminal cluster controller.

The cluster controller allows *Apricot*, *Sirius*, and *IBM PC* computers to be used as stand-alone systems and as intelligent workstations accessing the host *Point 7's* Winchester disk. In the latter mode, the *Point 7* and its terminals act as a multi-user system running under Multi-user Concurrent DOS. The ability of each terminal to function as a stand-alone computer reduces congestion on the cluster controller and enhances performance. Terminal

Market Segment	ACT System	Competitors
Home	None	Commodore 64 Color Computer
Education	F1e	Apple IIe Acorn (BBC)
High-end Home Low-end Business	F1	Apple IIe
Notebook	None	Tandy Model 100, et al.
Full-function Portable	Portable	Compaq IBM Portable
Desktop	Apricot PC	IBM PC
Desktop, Mass Storage	Apricot Xi	IBM PC XT
Multi-user	Point 7 Point 32	Altos 68000 Unix systems

computers must be located within 50 feet of the host system.

Software for cluster use furnished with the *Point 7* includes the ACT *Diary* package which permits a group diary to be maintained, and the *Pulsar* integrated accounting package. *Pulsar* also plans to make other packages in their line available for the *Point 7*.

Local Area Network System

The *Apricot Point 32* is a local area network system that allows up to 32 *Apricot*, *Sirius*, or *IBM PC* computers to gain access to up to 200Mb of mass storage, with the added security of cartridge tape backup. The system uses a device called The Bank and Omnet card made by Corvus. The software is a new system developed by Microsoft called MS-NET.

The heart of the *Point 32* is an enhanced 10Mb or 20Mb *Apricot* with ACT LAN (local area network) cards. This acts as a file server to a network of personal computers linked via the Omnet card. Up to ten file servers can be included in the network. Computers in the net can be located up to 2000 feet from the host.

Pricing and Availability

U.S. prices have not yet been set on the new *Apricot* line, but judging from the U.K. prices, the line will be priced very aggressively. At the current rate of conversion, the F1e would sell for about \$1200 and the F1 for about \$1500. These prices do not include shipping or import taxes so the final prices will be somewhat higher.

Micro-D has just signed a contract with ACT to be the exclusive U.S. distributor. Given Micro-D's excellent coverage of the market, you can expect to see *Apricot* on the shelves of a wide cross section of stores throughout the country.

ACT promises that the new computer will begin shipping in about 60 to 75 days to the home market. That means they probably will not hit these shores until early 1985. Frankly, we can't wait!

ACT (North America) Inc., 3375 Sec Blud., Suite 336, Santa Clara, CA 95050 (408) 727-8090.

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CIRCLE 126 ON READER SERVICE CARD

Apple Macintosh

Truly a Breakthrough?

Whether or not the Macintosh is actually a breakthrough, it surely *looks* like one. It doesn't look like much of anything that has come before (with the possible exception of the moribund Vectrex videogame unit, which, if painted beige, would bear a startling resemblance).

The Macintosh is small. With a recessed handle in the top of the main unit and a total weight, complete with internal CRT, of 22 lbs., the Mac qualifies as a bona fide *transportable*, meaning you can move it around relatively easily when the time comes. Drop it into its custom-made rucksack (a \$100 option), and take off.

Sit it on your desk, and you will quickly notice how little room it takes up. Its footprint is barely larger than a sheaf of papers. And though the unit is rather bizarre-looking at first glance, it is also rather handsome. Its looks grow on you.

The Keyboard

Attached by a modular phone cable to the main unit is the detached Macintosh keyboard. This is a 58-key, full-stroke Selectric-style layout (see Figure 1), with a somewhat stiff but very professional feel.

Based on my experience with the Mac, I think it is unlikely that you will ever be pulling the keyboard onto your lap. Still, the detached design is desirable. It makes comfortable positioning of the keyboard entirely independent of comfortable po-

John J. Anderson

sitioning of the screen, and that is extremely important. At the same time, the keyboard can be pushed away in an instant, so that you may reclaim precious desk space when access to the keyboard is not immediately necessary.

Noticeably lacking on the Macintosh keyboard are special function keys and directional cursor movement keys. These are replaced by the mouse pointer peripheral from which the Mac receives all directional inputs. I am told that cursor movement keys appear on the add-on numeric keypad (a \$130 option), but these are not read interchangeably with mouse movement. We shall be examining this question more closely up ahead. As for special function keys, the idea is that the mouse renders them unnecessary.

The Mouse

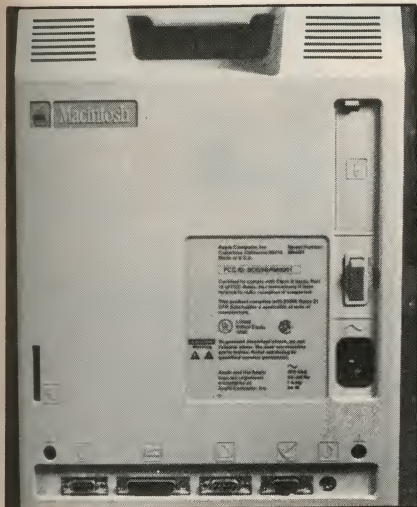
Then there is the mouse itself. Though it is a tiny thing, better clear at least a square foot or so of desk space to move it around. The more room you make for it, the easier control of the mouse becomes.

As you move the mouse, an on-screen

cursor mimics your moves. At first, controlling the screen cursor with the mouse is anything but intuitive. The mouse seems cumbersome, and hard to control for detailed work. (Unlike the Summa Graphics mouse, by the way, tracing is out of the question.) With a few days of practice, however, working the cursor with the mouse becomes second nature. (Once you learn to lift the mouse when you run out of desk space and reposition it so that you have the room you need, you have learned the major secret of effective mousing.)

The mouse has a mechanical device with a rolling ball inside it, as opposed to optical or pull tracking, to measure relative movement. Therefore your desk area must be free of dust and particulate matter (such as Ritz cracker crumbs) for the mouse to work reliably. The documentation actually tells you how to remove the ball for an occasional cleaning.





Rear of system unit.



Figure 1. Detachable keyboard allows comfortable positioning.

The Mac mouse has a single button on its top. Hence there are no inhibitions concerning which button to press when the time comes to press a button. It is impossible to make the wrong choice. When designing a mouse for ease of use, a single button helps considerably.

Double-clicking the single mouse button frequently also acts as a short-cut mechanism, to obtain certain functions.

The System Unit

The major business goes on inside the main unit of the Macintosh, so let's get a closer look at it.

Your first concern about the system component is bound to concern the CRT display. Is a 9" diagonal screen truly big enough to allow extended viewing without fatigue or strain?

The answer in this case is yes, and the reason is the super-high screen resolution of 512 x 342 monochrome pixels. Add to this the fact that nearly all text reads out in black type on a white background, emulating an actual printed page, and you have an exceptionally legible display. Not once have I found myself lamenting the diminutive screen size. Indeed, after a few minutes on the Mac, you will dismiss that question for good.

The Microdrive

Also appearing on the front of the main unit is the doorless disk drive slot. A single-sided 3 1/2" Sony microfloppy drive is standard and internal to the system unit of the Mac. Each disk can hold approximately 400K of data on a single side. In addition, the disks themselves can take much greater abuse than conventional floppies.

Each disk has a spring-actuated sliding aluminum cover on it, which the Macintosh opens automatically when the disk is inserted, and shuts automatically upon ejection. Thus the head slot is protected at all times. The disk case is rigid, and as

you may have heard before, "slips into a shirt pocket."

Apple uses a proprietary technology to get 400K onto a side: nearly 100K more than the conventional Sony format. More importantly, this effectively eliminates the possibility of third-party Macintosh "work-alikes." This is a good indication of the savvy that went into the design of the Macintosh.

At times, when a disk is spinning in the drive, it sounds jarringly like a cheap friction toy. This is because the Macintosh drive utilizes a variable RPM speed. The result is the ability to write more data to the outer disk tracks. Drive rotation speed varies from 390 to 600 RPM, depending on the track.

No read/write light is necessary on the Mac drive; when a disk is in the drive you cannot remove it without undertaking rather drastic measures. Nor is there a disk eject latch or button. Disk ejection is controlled entirely through software, as we shall discover ahead.

If, as a result of some emergency, you *must* manually eject a disk from the drive, you can effect this by pressing the point of an unbent paper clip into a small hole beneath the drive slot.

The only other features of the system unit front side are the brightness knob and the keyboard input jack. The brightness knob is the only CRT control externally available on the Mac, and the only

one necessary. The keyboard input consists of a modular telephone jack.

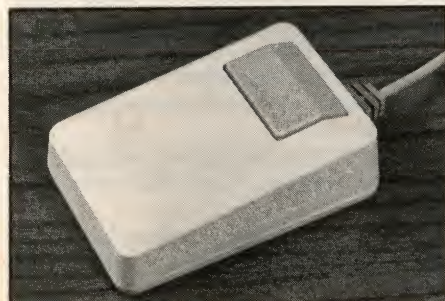
Inside the main unit is an unimposing 9" x 9" circuit board with a 32-bit 68000 central processor chip residing upon it. The CPU runs at 7.83 MHz, which is fast indeed (see Figure 2 for the benchmark test results). The Mac sports 128K of RAM and 64K of ROM. Six special chips are most responsible for compactness of the motherboard. Each in itself is the equivalent of an actual circuit board.

A major benefit of Apple's advanced motherboard design is not only compactness, but the fact that the system does not require a cooling fan. If there is one thing that drives me to distraction on certain micros which shall remain nameless, it is the constant hum of their cooling fans. Computers can, and should, run in total silence.

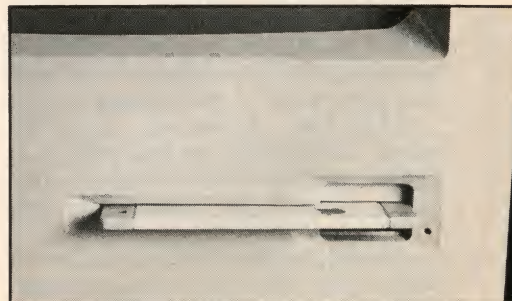
Except when we *want* them to make noise, of course. The Macintosh has four-channel multi-octave sound synthesis capability. This capability can create beautiful music and can certainly be translated into state-of-the-art speech synthesis as well. Macs are bound to become the most talkative microcomputers around before too long.

Documentation

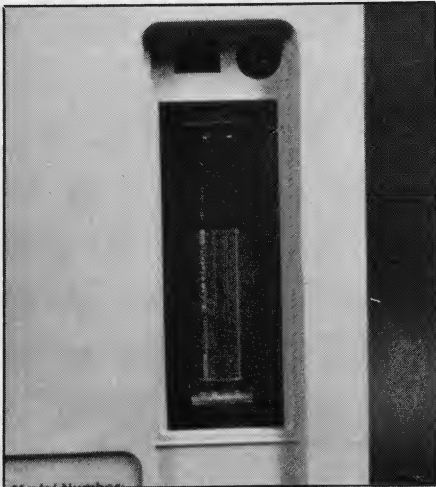
Macintosh documentation is uniformly superlative. It is colorful, thorough, lively, and fun to read throughout. IBM could



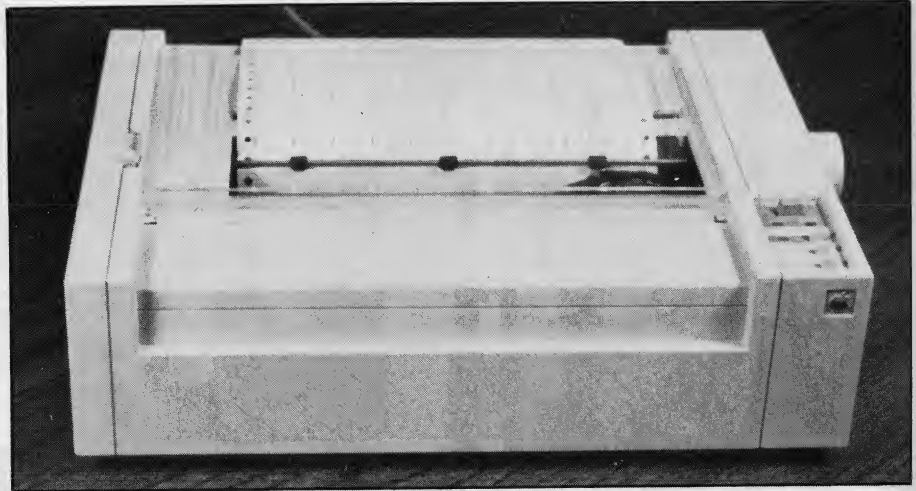
Macintosh mouse: point and click.



Internal disk drive slot.



Internal battery powers clock/calendar.



The Imagewriter makes full use of the Macintosh graphic capabilities.

take a lesson from Apple on this account. Included with the documentation is a training disk and audio cassette. The cassette is from Windham Hill Records and includes some very mellow jazz piano. Like the Mac itself, the Mac documentation exudes simplicity and class.

As we shall now discover, the Macintosh is very easy to use, just as the documentation is easy to read. The entire goal was to create a system that is powerful, yet utterly painless to use.

Systems Software

The following program is provided on the systems disk:

- **Finder.** A document management system that allows creation of new documents, opening, closing, copying, renaming, and deleting of existing documents, applications, and files, and movement of same on or between disks and folders. Folders allow documents to be arranged hierarchically. Finder allows you to obtain directories by icon, name, date, size, and kind.

The following systems functions can be called up during Finder or any other application, and concurrent with each other:

- **Calculator.** Looks, and works, just like an actual calculator. Results can be cut and pasted into other documents or applications. Numbers can be entered from the keyboard, numeric keypad, or using the mouse to point and click screen "buttons."

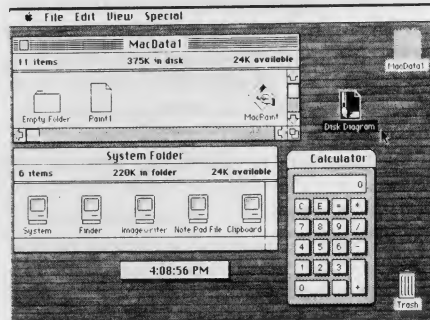
- **Clock.** Shows the current date and time. You can copy the date and time to paste into other accessories or documents. You can also set an alarm function.

- **Key Caps.** Allows you to use the mouse to enter text. Its real utility is to display available special graphics characters obtained by holding down the OPTION or SHIFT key.

- **Puzzle.** A pure bit of whimsy. Something to play with when you need a break. A sliding tile puzzle simulation that will

take you back to your childhood. Documentation quote: "unfortunately, you can't pry out the little plastic tiles when you get frustrated."

- **Note Pad.** A place you can jot down a few notes and keep them separate from the document you are working on. Or type text and edit it even if you are using an application that doesn't allow for text editing. Using the cut and paste option,



Display of some systems functions.

you can move text from the notepad to a document or application.

- **Scrapbook.** A place to keep pictures and text you use frequently. This might include your letterhead or even a "moused" version of your signature. A graphic equivalent to the text storage of Note Pad.

- **Control Panel.** Lets you set system defaults, including speaker volume, date and time, blink rates, key repeat rate, keyboard touch, mouse sensitivity, mouse double-click speed, and desktop graphics pattern. Most control pattern settings are remembered even when the system is powered down.

The following packages are offered free for a limited time to the Macintosh purchaser:

- **MacPaint.** The most powerful monochrome graphics system ever offered on a microcomputer, MacPaint is the showcase program for the Macintosh and currently

the best available demo of the capabilities of the machine. It gives you a set of tools (Figure 3) that allows you to create sophisticated screen graphics in seconds. Contrary to the opinions of some reviewers, I believe MacPaint does provide dramatic new abilities even to those who lack underlying skills. Perhaps you literally "cannot draw a straight line"; the Mac will make sure the line you draw is straight. I have been needing a tool like MacPaint for a very long time, without even knowing it. Now in 20 minutes I can create charts and diagrams that would have been scrubbed before the Macintosh appeared because of the time and effort they would have required.

MacPaint is an image processor that handles images in the way that a word processor handles text. Its resolution is extremely good. Figure 4 is an example, drawn in about 40 minutes by Karen Brown of our typesetting department. Figure 5 took her about half that time. Total effort was nearly an hour.

As a graphics aid, MacPaint is a serious tool. And as a toy, it is exquisite. It is the ultimate executive doodler.

- **MacWrite.** The ultimate "see what you'll get" word processor. Easy to use, yet powerful. Does most things you might expect, including moving blocks of text, find and replace, line spacing, headers and footers, centering, margins, page numbers, justification, tabs, and decimal tabs.

In addition to the expected functions, MacWrite has some special functions all its own.

For starters, what you see on the screen is exactly what the finished document will look like. There are no embedded codes. Because even the "text mode" of the Macintosh is entirely bit-mapped as hi-res graphics, you can look at the CRT and see the printed page.

In addition, you may choose between multiple fonts, multiple point sizes, and multiple style options including bold, italic,

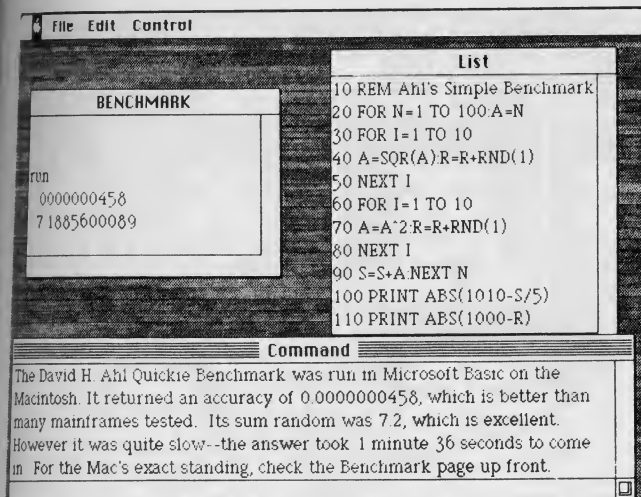
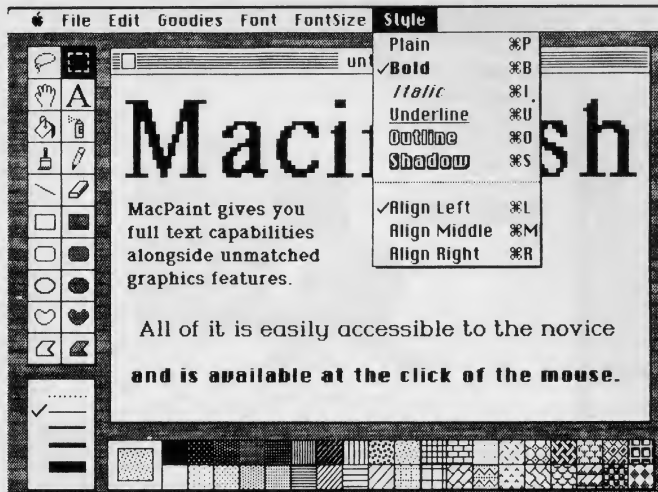


Figure 2. Benchmark program and results.



Pull-down menu overlaps Macintosh logo.

underline, and "shadowed" text. If and when you choose to reformat a document, changing a margin or line-spacing, the document reformats right before your eyes on the screen. There is no guesswork with MacWrite concerning the look of the hard copy. If you are coming from a word processor that would print an entire document underlined because you forgot a single closing underline control character, you will find MacWrite an extremely refreshing development.

All text selection functions are performed by the mouse. Position and click, then move through the text you want to mark and it will automatically be highlighted. Position and click. Now you can cut and paste, move, delete, copy, change font, point, or alter typestyle of the selected text.

To change formats within a single document, you simply insert a new ruler, reflecting the format change. If you wish then to return to the original format at a later point in the document, simply copy and paste the original ruler itself at the point you desire.

You may also paste graphics created with MacPaint directly into MacWrite files.

Other Announced Software

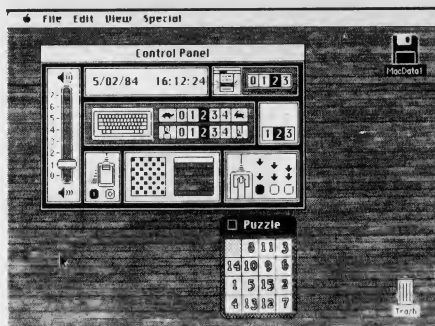
In addition to these two already released packages, Apple has announced the following packages for release soon:

- *Mac Terminal*. A terminal communications package for the Macintosh.
- *MacDraw*. A business graphics package.
- *MacProject*. A project management system for supervisors.
- *Macintosh Basic*. Apple's version of the popular programming language will allow a program trace to run alongside a listing in one window, while the program itself runs in another.
- *Macintosh Pascal*. Apple's Macintosh Pascal will be interpretive rather than compiled, which may make Pascal a popular

Mac programming environment.

- *Assembler/Debugger*. What every 68000 aficionado is waiting for.
- *Macintosh Logo*. Announced for release in the fall.

Microsoft has announced several Macintosh packages for imminent release, and Microsoft chief Bill Gates has voiced a serious commitment to support of the Macintosh machine. We wanted to get a look



The Control Panel allows the user to configure Mac defaults.

at Macintosh *Multiplan*, the popular linking spreadsheet package, but no release copy was available at press time. We did manage a look at Microsoft Basic for the Mac. Other packages promised by the company are *Chart*, a business graphics package; *Word*, a word processing program; and *File*, a database management system.

There is that word *promised*; a little alarm should go off in your head whenever you encounter it. We were promised a copy of *Multiplan* nearly two months ago and have yet to see it. That sometimes happens with promises; they get broken.

Taking the Bads with the Goods

The astute among you may have detected by now that I have been storing up my criticisms of the Macintosh—holding them in abeyance until the full complement of Mac "goods" was laid before you. It should be obvious to you now that the

Mac does represent a significant breakthrough, both in hardware and in software.

It should also be clear that the true concern is whether the machine will live up to its undeniable promise.

Fine. It is now time to lay out the "bads."

• *The Macintosh does not have enough RAM memory*. To those of us used to 48K and 64K machines, 128K may sound like plenty. But that is a rather misleading statistic. Between the video display, operating system, and an application like MacWrite, when booted, you are left with little more free RAM than a typical Apple IIe.

The answer we have heard regarding this complaint is that when 256K RAM chips become available, you will be able to upgrade your Macintosh to 512K. This is a promise that will undoubtedly be fulfilled. The question is *when* 256K RAM chips will become available, and how much they will cost. An optimistic guess might be Christmas or so, but you never know. We are depending on the Japanese to provide us with plentiful 256K technology.

As for cost, well, chips are expensive when they're newborn. At the outset, 256K RAMs might cost upwards of \$80 apiece. That would make the Mac memory upgrade quite a costly one. And who knows what Mac owner demand might do to RAM chip prices?

The bottom line on this point is that it might be two years or so before you can inexpensively give your Mac enough RAM to be truly useful. And it is possible that large-scale software development for the Mac will be stalled until 512K systems become standard.

• *Single microfloppy storage is slow and inadequate*. One arena where Apple has not fared well of late is in custom drive configurations. Sony drives on other systems run quickly and silently. That is why I was surprised that the single-drive Mac system is so slow and cumbersome. Creating a new startup disk seems to take

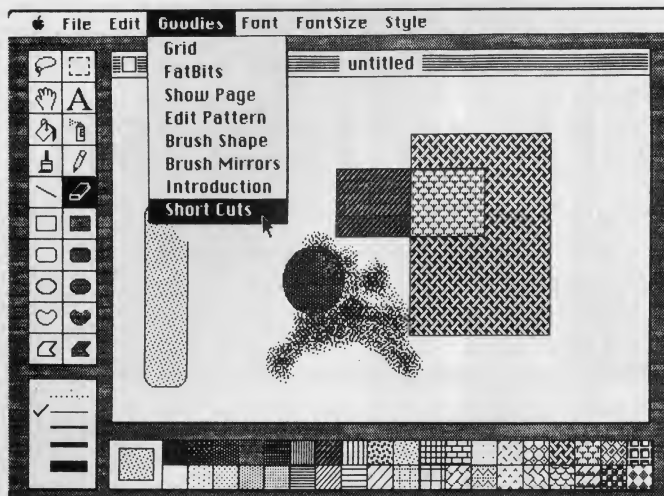


Figure 3. MacPaint palette.



Figure 4. Single portrait manipulated by MacPaint.

an eternity, and repeated disk swaps are the norm.

As with the RAM situation, 400K storage is a misleading figure. The operating system takes up fully half of that, and a typical application program, such as MacWrite, another 50K. That leaves little more free disk space than on the typical Apple IIe drive.

External disk systems will not be available for some time, as the limited supply of existing Sony drives must be earmarked for new Macs. And even the availability of the external drive will not transform Mac storage as dramatically as one might hope.

The best answer to this problem is the promise of the Sony double sided drive. This could become the default external drive system, to be used in conjunction with the existing single sided internal drive.

Certainly some type of hard disk will play a big role in the Mac's future, and as all software applications we have seen so far have been released without copy protection, application programs could be moved over to hard disk easily. Davong has announced a third-party Mac Winchester drive for release soon.

I must also register displeasure with the disk ejection procedure. To remove a disk from the drive, you must close everything down, quit your current application, and request an eject from systems software. I understand that this procedure is for my own protection, but it is a drag. In a way it reminds me of 1975 cars. Remember those? They wouldn't start unless you had your seatbelt fastened.

Everybody ended up hot wiring them to get around the interlock—even people who wear seat belts. I can just imagine a pile of unbent paper clips sitting in front of every Macintosh in the nation.

• *There are no internal expansion slots or external expansion busses.* What's the big deal about that, right? The Mac already has everything you need. Well you might

have said the very same of the old Apple II back in 1977. So many expansion slots, way back when there was no firmware to plug in them. That situation changed quickly. Nowadays many Apple owners wish they had another three or four slots. By precluding easy hardware expansion on the Mac, Apple writes off a major component of its early success—expansion flexibility. Sure, it might take some imagin-

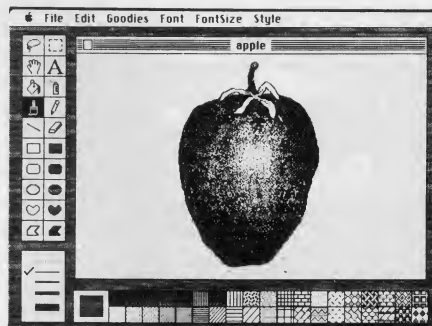


Figure 5. A MacPaint original.

ation at first to envision the kinds of cards the Mac might need. But if an expansion bus were available, people would start to invent them.

On the same score, it is lamentable that the Mac does not sport an internal modem standard (or at least the capacity to add a modem internally). The circuitry is much less expensive than it typically sells for and is certainly compact enough to have fit inside the Mac. To charge an extra \$300 for the external Mac modem almost suggests—I shudder to say—tactics typical of Apple's main competitor.

• *MacWrite has some severe limitations.* Although MacWrite has some very refreshing features and is a joy to use overall, it is not a serious word processing tool. Part of this relates to the RAM and disk storage shortage of the machine. I was flabbergasted to discover that the 128K Mac is capable of supporting MacWrite documents no longer than 10 pages in

length. After it reaches the last available byte, it will accept not one more character. And to make matters worse, document files cannot be chained.

Other problems, however, will not be remedied by a simple RAM upgrade. Lack of directional cursor keys, for example, was to my mind a major omission. I understand and appreciate that the mouse is quite capable of handling this input for me. But when all I wish to do is move the cursor to the lefthand margin and up six lines, I would like to do it without having to remove my fingers from the keyboard.

Many application functions on the Mac make use of "expert keys" to allow shortcuts through nested menu selections. My general understanding of pointer philosophy has always been to offer a choice. *Both* means of control should be constantly available, so that the decision of how to input is left to the user. To have eliminated keyboard cursor movement entirely from MacWrite is in my opinion a flagrant example of mouse chauvinism on the part of Apple.

MacWrite will not calculate a word count, has no spell-checking, merge, or hyphenation capability, and will not allow a column width wider than 80 characters.

In short, MacWrite in its current form is too limited to be of real use to anyone who does a lot of writing.

• *The system is monochrome-only.* Despite rumors to the contrary, the Macintosh is likely to remain a black and white system. The circuitry to drive a color printer is already in place, but don't bother holding your breath for an ultra-hi-res RGB tube to replace the current Macintosh CRT.

• *MS-DOS compatibility is ruled out.* As I have said many, many times, though MS-DOS may be a mediocre standard, it is a standard nonetheless. Apple has decided to challenge IBM on this and could not have started off on better footing than it has with the Mac. But if it is IBM

SYSTEM PROFILE

Name: Apple MacIntosh

CPU: 68000 32-bit Motorola microprocessor

Memory: 128K RAM, 64K ROM

Disk Drives: One single-sided 3 1/2" microfloppy drive (400K storage)

Keyboard: Detachable 58-key fullstroke keyboard

Dimensions: 13" x 10 1/2" x 9 3/4"
22 pounds

Sound: Four-channel sound/music

Display: 9" diagonal b/w bit mapped monitor 512 x 342 pixel graphics resolution

System Software: System software supplied in ROM includes Group Code Recording disk operating system and QuickDraw graphics package.

Desktop Accessories: Calculator, Clock, Puzzle, Control panel, Scrapbook, Notepad, and Key caps. Additional desktop software includes Wastebasket, Get Info, Disk Copy, and Clipboard.

Instructional: Guided Tour learning system disk with audio cassette. MacWrite and MacPaint included free for a limited time.

I/O Ports: RS-232/RS-422 connector

Other: Mouse controller, clock/calendar (battery backup), modem/AppleBus connector, second disk drive connector (may also be used with a hard disk when available)

Summary: Without a doubt, a hardware and software breakthrough.

Price: \$2495 for Macintosh
\$2990 for Macintosh and Imagerwriter Printer

Manufacturer:
Apple Computer, Inc.
20525 Mariani Ave.
Cupertino, CA 95014
(408) 996-1010

compatibility you have in mind, don't look to the Mac. If you must have an IBM-compatible Mac, you can buy a Compaq and plug it into the same power strip.

• *The Macintosh will not multitask.* I mention this not as a criticism, but because it is a fact largely overlooked by Mac reviewers. The main difference between the Mac and the Lisa is that the Lisa can run more than one program at a time. Not so the Macintosh. You may open multiple document windows from MacWrite or from the Finder. But whatever multitasking abilities the Mac finally inherits will come from cleverly designed software modules—not from within the Mac itself. It is a tribute to Apple's marketing that this fact has remained so obscure.

• *You can't use a Mac away from a desk.* Unless you have a place to do your pointing, you won't be going very far with your mouse. It would be nice if Apple or a third-party company were to offer a MacBall trackball, so that the Mac could be used in bed, reclining on the couch, or in the back seat of a Buick. Our artist/typesetter Karen Brown said she would have preferred using a graphics tablet to compose her drawings. Perhaps Koala Technologies will remedy this situation shortly.

• *MacPaint has an easel size limitation.* The screen window cannot be re-sized from MacPaint; it presents a 4" x 6" window on an 8 1/2" x 11" page. It is still quite possible to draw shapes larger than the window size, but the process may seem disjointed and cumbersome.

• *Forget about external video.* Because of its non-standard ultra-high resolution, there are no plans to offer a larger, external Mac monitor. The lack of an external video connector jack bespeaks this. I feel this may change as the Mac enters college classrooms, however. Having taught my share of microcomputer courses, I can vouch for the tremendous help a second monitor can be when 40 students all need

to see the same screen at the same time. With the Mac going into colleges and universities nationwide, a remedy to the external video restraint may be forthcoming.

• *Macintosh software development is an involved process.* Although many interface aids are offered in ROM, development and debugging of Mac programs is currently slow going. Witness the delays from even the largest and smartest software houses around. Because the Mac strives for such high standards, it calls for the absolute most from the absolute best. As a result, it is unlikely that Macintosh software packages will flood the market before the end of the year.

I have never criticized a new machine for the lack of software. When the IBM PC came on the scene, there was literally nothing available for it but a buggy word processor. The Macintosh debuted with MacWrite and MacPaint, both of which have been thoroughly debugged, and these programs promise an unbeatable standard of software quality.

Closing Arguments

I simply wonder if this standard can be upheld. The thought first occurred to me as I played around with Microsoft Basic. A Basic program running on the Mac looks very much like a Basic program running on any other machine, except for its windows. Without the icon/window/menu shells, the Mac is reduced to a rather average machine.

It is up to talented programmers to make the most of Macintosh ROM in every program they develop. With it they can meet the ambitious promise that is the Apple Macintosh. Otherwise the Mac may never develop the staying power it needs.

We are still quite some distance from the ideal machine Alan Kay envisioned back in 1971 and christened the "Dynabook." This is a computer the size of a Model 100 with the power of a hundred

Macs. In a recent interview, he rather cynically predicted that it would be the Japanese who would make the Dynabook a reality. He told Allen Munro of *St. Mac* magazine that the Macintosh was in point of fact "no big deal."

That's the problem with people who are vastly ahead of their time. The times never seem to catch up. The Mac clocks in at 8 MHz, but Kay is already imagining what he could do with 12MHz. In my last vestiges of prideful nationalism, I only hope it is Apple, not NEC, that introduces a 1000K 12 MHz machine two years from now. Perhaps I will write about it using a truly professional word processor running on a 512K hard disk Macintosh.

Of course Kay will still be cranky with it, even when it does happen. If only he had 20 MHz and 5000K in a case the size of a box of Milk Duds. Then he could really make things happen.

Well if anybody can pull off *that* kind of miracle, it is probably Apple. Those folks show a lot of promise. END

CIRCLE 492 ON READER SERVICE CARD



The Epson QX-10 and the Valdocs operating system represent an ambitious attempt to produce a new generation of truly user-friendly microcomputer systems. Because of this bold new direction, the system deserves to be evaluated from two different points of view: as a stand-alone microcomputer and as the first step in the evolutionary progress toward a jargon free, user-friendly ergonomically designed microcomputer.

This review covers the standard QX-10 with two disk drives, the HASCI (for Human Applications Standard Computer Interface) keyboard, and Valdocs

Roger H. Edelson

version 1.18. This version of the Valdocs (short for Valuable Documents) may represent the last issue of version 1.x software and is both an improvement over, and a cleanup of, earlier releases.

There remain some problems with Valdocs at this point (mainly in response speed), but remember that before you can run you must walk. Actually, version 1.18 is probably more akin to a baby's crawl; and according to Chris

Rutkowski of Rising Star Industries, the proud parents of Valdocs, 1.18 ends the crawling period.

Version 2.x will signal a new phase of greatly improved capability and speed, and version 3.x will put it all together, add the few missing business application modules, and really run—we'll see.

While most of the innovative design on the QX-10 has been poured into the Valdocs operating system and its supporting HASCI keyboard, the hardware design is also well thought out.

The computer is divided into three attractive light cream colored packages:

Epson QX-10

The Friendliest Computer Around



the main electronics unit, the 12" (diagonal) monitor, and the detachable keyboard. Charcoal coloring has been used for the disk drives, the insert surrounding the CRT, and the keys to provide an interesting and eye appealing contrast. The total system weighs in at just under 40 pounds.

The System Unit

The heart of the QX-10 is the electronics package or main system unit which houses the two thin (1.5" high) disk drives, the Z80A CPU, a speaker, memory (RAM, ROM, and battery

HARDWARE PROFILE

Name: Epson QX-10 with Valdoks and HASCI

Type: Medium to high end business system

CPU: 8-bit Z-80A; 4 MHz

RAM: 64K to 256K RAM; 8K ROM; 2K RAM, battery supported

Keyboard: 104 Keys, full-stroke, non programmable HASCI, or programmable ASCII architecture

Text Resolution: 80 x 25

Graphics Resolution: 640 x 400 pixels

Color/Sound: Monochrome green; speaker controlled by timer

Ports: Parallel, Centronics-compatible; serial, RS-232C

Dimensions: CPU 20.3" x 13.6" x 4.1"; Monitor 12.4" x 13.6" x 10.6"; Keyboard 20" x 8.9" x 1.9"

Documentation: Manuals are average, operating system contains self-help.

Price: \$2995 with dual, double-density 5.25" drives.

Summary: A mature design of an 8-bit machine with an innovative and extremely user-friendly operating system and supporting keyboard.

Manufacturer:

Epson America, Inc.
2780 Lomita Blvd.
Torrance, CA 90505
(213) 539-9140

Most of the innovative design on the QX-10 has been poured into the Valdoks operating system and its supporting HASCI keyboard.

backed-up CMOS RAM), and the I/O. This unit is just a little over 4" high and occupies a 20" wide by 13.6" deep footprint, which is not overly large given its formidable capability.

The disk drives are somewhat unique in that they are made by Epson and employ a voice-coil linear actuator for the head positioning, rather than the familiar stepper motor technology. This actuator design, usually found only on hard disk drives, provides fast track-to-track stepping speeds and is extremely quiet during operation. In fact, the noise of the drive is almost entirely masked by the noise of the small muffin cooling fan.

This fan represents what might well be the only mistake that Epson made in their hardware design. The diminished height of the main unit requires a very small fan which must turn at a high (and noisy) RPM to move the air. Even worse, the fan blows the air directly out of the unit. With this arrangement, room air (along with all its contaminants) is sucked into the machine through every opening in the case, including the disk drive slots. A much better design draws the air into the fan through a filter then disperses it throughout the electronics and power supply areas and finally forces it out of the case through the drives and outlets. This flow pattern limits the amount of trapped grit, dust, and dirt on the disks.

The design Epson has chosen for the disk insertion and removal operation is also different, but it has a nice positive action which I like. The disk is inserted as in all drives, but once it is fully seated in the unit a small latch clicks into place, holding it firmly; there is no drive door and no possibility of closing the door and crunching an improperly inserted disk. Next, the small button on the upper left front of the drive must be pressed firmly to inform the drive, and the system, that the disk is in place.

This button is also used to remove the disk. It is designed as a mechanical toggle, and a second push performs this operation. The Valdoks system waits ever so patiently until the system disk has

been inserted in the left drive, displaying a message to INSERT DISKETTE.

The system also notifies the operator if the data disk has not been inserted into the righthand drive; it really is user-friendly. The machine performs a self-test when you turn it on, and checks the printer—at the same time. It will inform you if the printer is not connected, if it is out of paper, or if the I/O interface is not correct. Mine complained for weeks, until I finally located a missing wire in the extension cable I had added. (It was not Epson's fault; the cable manufacturer had left out one handshaking signal line.)

The Z80A CPU operates at a moderate 4MHz clock rate, but it is able to access a remarkable (for an 8-bit machine) 256K of RAM under Valdoks (only 64K in the CP/M version), 2K of CMOS RAM supported by a backup battery, and up to 8K of ROM housing the basic boot routines. This ability to use more than the 64K of memory, which is normally the maximum for an 8-bit machine, somewhat negates the main advantage of the newer 8/16 machines, since the faster computational speed of the latter chips has not proved a major factor.

Actually, the main unit of the QX-10 has even more memory than is available to the Z80A. There is another 32K to 128K of dedicated memory supporting the bit-mapped video monitor. The overall design represents a well thought out, fully mature implementation of an 8-bit microcomputer system, and the avail-

The overall design represents a well thought out, fully mature implementation of an 8-bit microcomputer system.

ability of CP/M 2.2x as an alternate operating system assures a large base of available software.

The Display

The display is an easy-on-the-eyes, high-persistence, monochrome green phosphor monitor, which provides a moderate- to high-resolution 640 x 400 pixel display. The CRT uses an etched faceplate to reduce the reflected glare of ambient lighting, but no provision has been made to adjust the viewing angle—a minor irritation.

The display is pleasantly clear and readable, and in the text processing

mode provides an 80-column by 25-line display. The last line is used for status information such as the line spacing, page number, line number, character position, and the time (kept current by a battery powered clock calendar).

The only feature of the monitor which takes a little getting used to is the length of the phosphor persistence. The characters take somewhat longer than normal to fade out and move.

The Keyboard

The keyboard is unconditionally excellent; it ranks with the best units I have handled in terms of stroke, feel, appearance, and arrangement, and the HASCI architecture makes operating the Valdocs system both logical and easy. Another version of the keyboard, a standard ASCII arrangement, is also available for users who want just a Z80A CP/M system.

The two-color keys (charcoal and dark grey) are divided into four functional groups, consisting of a collection of 61 standard text keys, a separate numeric pad (including the four calculation keys, a separate ENTER key, and even a decimal tab key), an editing and cursor movement group, and the Valdocs specific function keys, which are arrayed along the top. Epson really designed this layout well; too many other computers skimp on the keys making the numeric pad to do double duty as the cursor movement keys. This shared

The real difference between the HASCI keyboard architecture and other computers is embodied in the 17 specialized Valdocs control keys.

key arrangement greatly slows down data entry when using a spreadsheet program, but that is not the case with the separate functions of the QX-10. Even with the extra keys, the keyboard is not unwieldy. It is the same width as the main unit (20"), less than 2" high, and only 9" deep. It rests comfortably on either desk or lap, weighing in at 5.5 pounds.

Speaking of fast data entry, Epson forgot the little bump in the center of the 5 key, a feature which makes data entry considerably faster and easier. The detachable keyboard is connected by a coiled cord and a DIN type plug



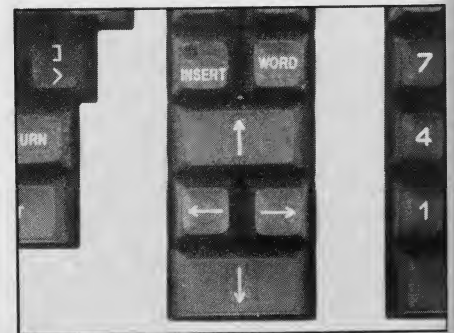
Epson QX-10 system, manual, and small easel (shows meaning of keyboard for various software systems).



Epson QX-10 keyboard is divided into logical clusters of keys.

equipped with a convenient lever that folds out to make removal easy. Using simple plastic adjustable legs, the tilt of the keyboard can be varied to suit the desire of the user. The key tops are sculpted, and have a matte finish. Five of the keys (SHIFT-LOCK, INSERT, CALC, SCHED, and DRAW) have internal LED status indicators.

But the real difference between the HASCI keyboard architecture and other computers is embodied in the 17 specialized Valdocs control keys, which are divided into four logical groupings. The first four keys on the far left are labelled System Controls and control the HELP,



Cursor keys are arranged in logical pattern. LED on INSERT key shows when it is "on."

COPY-DISK, and UNDO functions, plus a bright red STOP key. The STOP and UNDO keys are real error correctors; STOP halts whatever operation the QX-10 is currently pursuing, and UNDO allows you to reverse the last specified command. Oh, how many times I have wished for a key like this after deleting the wrong file under CP/M. Unfortunately, this is one operation the UNDO key does not provide, but the file handling routines force a second positive response from the operator before a chosen file can be erased.

The STOP key turns out to be more useful than expected. Because of the slow response time of Valdocs during some operations and the large type-ahead buffer (32 characters), it is possible to stack up a series of identical commands, such as view next page or retry disk access. The result is a very long wait while the computer patiently retries the operation over and over and over again. This is where the STOP key earns its keep: one press and the operation ceases at the end of the currently executing command and the buffer is cleared.

HELP and COPY-DISK are time savers; in particular it is almost magical to have a single button that automatically makes a backup copy of a disk. It takes a few minutes to do the job, and you still have to swap disks, but compare this with the CP/M operation, which requires exiting the program, calling up the copy program, and changing the disk.

***It is easy to use
English for file names
and provide enough
information to allow
the establishment of
simple relations
between different files.***

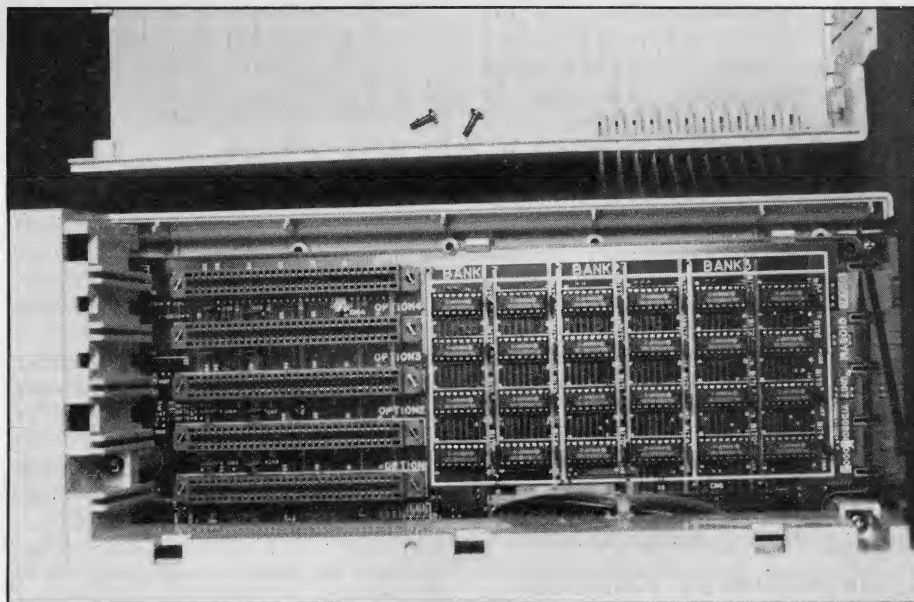
File Handling

The next group of keys (STORE, RETRIEVE, PRINT, INDEX, and MAIL) are the File Control functions, which provide a single-key implementation of the most commonly used file handling operations. With STORE and RETRIEVE, files are placed on, or removed from, disk storage. PRINT and MAIL send files either to a printer or to other systems via electronic mail. It is true that Valdocs 1.18 does not support a true save function with the store command, but the newer versions are expected to implement this function.

Among the most impressive features



Rear of the system unit has connectors for parallel printer, RS-232 device, monitor, and AC power cord.



QX-10 has five slots for add-on boards.

of HASCI and Valdocs in the file handling department are the INDEX key and the operation it commands. Instead of the limited eight-letter name and three-letter extension for files allowed by CP/M (i.e., FILEFOO1.ROG), in the 1.18 version of Valdocs every file (graph, document, database) may be indexed by a description of up to 16 keywords. That's right 16 words, and the index function ignores what Valdocs refers to as noise words—I, or, and, it, etc.

With this power it is easy to use English for file names and provide enough information to allow the establishment of simple relations between different

files. This function offers the power of a mini-database in a single key at the slight cost of increased time for file handling operations. For example, all my articles for *Creative Computing* can be found by indexing on those words or I can search for all articles or files on peripherals or printers.

Miscellaneous Applications

Most of us use our computers for more than one application. While I mainly use mine for text processing, there are times when I need graphics capability or want to schedule my appointments and meetings. With most

operating systems, to change from one task to another requires saving the work currently in progress, exiting the present program, entering the new program, and loading the correct file. Only then can the new task begin.

With the common sense, user-friendly approach of Valdocs and HASCI, the operator simply presses one key to change tasks. While Valdocs comes up in the word processing mode, all one has to do to change applications is select from the application keys, MENU, CALC, SCHED, or DRAW.

CALC turns the computer into a four-function calculator which can place numbers in the text or total a row or column of figures which already exist in the document.

SCHED provides a time management function, and DRAW offers a powerful graphic capability. Each time you change applications, Valdocs automatically saves the work which was in progress.

Word Processing

The QX-10 word processor works on visual and actual pages. The visual page consists of the 60 characters by 24 lines displayed on the screen, while the actual page is the 55 lines of text which will be printed. A horizontal line marks the actual page break on the screen, and a status display is always present.

The status display shows the visual page, lefthand margin, line spacing, current actual page number, current line number and character (cursor) position on that line, Replace or Insert mode, tab settings, righthand margin, time of day, and a vertical righthand flag line which indicates the applicable line codes, such

All the normal facilities you would expect in a word processor are available in Valdocs.

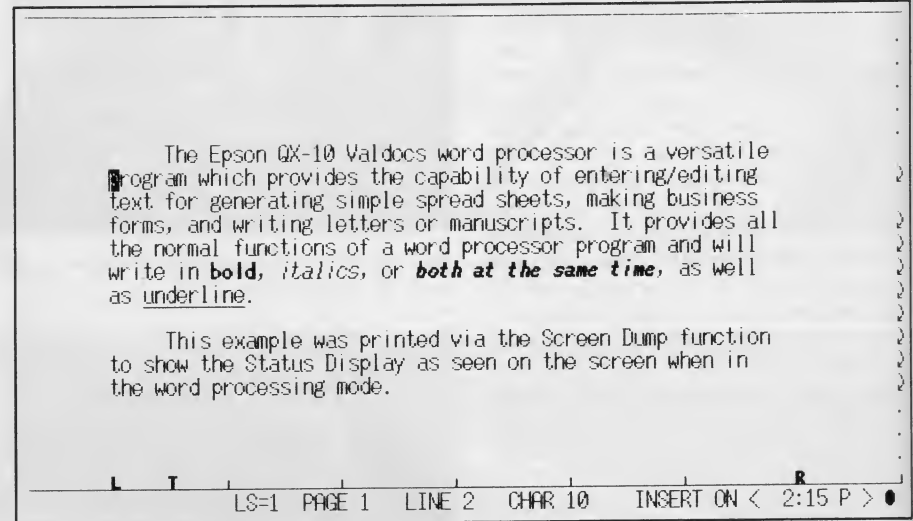
as carriage return, word wrap, characters past the margin setting, etc.

All of the normal variables may be set by calling up one of the various editing menus and inserting new values. No other "work windows" are displayed during normal editing. Files may be merged, for example, to place a letterhead file at the beginning of a form letter held in another file.

All the normal facilities you would expect in a word processor are available in Valdocs, including justification, block moves, reformatting, insertion, and search and replace. With just the word processor and calculator it is possible to

Quarterly Expenses 1983				Quarter
	January	February	March	Sub Total
Magazines	\$40.50	\$0.00	\$17.50	\$58.00
Postage	15.00	17.20	43.00	75.20
Telephone	1.75	.45	3.85	6.05
Office Supplies	23.00	5.75	43.91	72.66
Mileage (20.5.)	10.25	6.80	37.89	54.94
Electricity (10%)	14.20	13.21	15.67	33.08
Rent (10%)	51.50	51.50	51.50	144.50
Printing	0.00	0.00	34.35	34.35
Advertising	0.00	15.75	43.75	59.50
Misc. Materials	13.98	3.73	17.77	35.48
Monthly Sub Total	\$170.18	\$113.94	\$309.19	
Quarterly Total				\$567.71

Use of Valdocs word processor with the CALC function.



Valdocs software provides a Document Window and Status Display for data entering/editing.

create spreadsheets and other business related forms.

Valdocs also offers a spooling facility which will queue up to three documents to be printed, releasing the CPU for other tasks.

With the QX-10 in the text processing mode, the final group of keys (BOLD, ITALIC, SIZE, and STYLE) take effect, providing a true what-you-see-is-what-you-get document presentation. The QX-10 uses its bit-mapped graphics capability to display italics, bold, and underlined text. Under version 1.18 the STYLE key provides underlined letters and the SIZE key allows the display (and the printed output) to vary the line spacing selection for one, two, or three lines.

To some degree, it is this graphic depiction of text that slows down the word processing function—perhaps the loudest complaint lodged against Valdocs. Notice that I didn't say the QX-10; under CP/M, running other word processing software, the computer is as fast as most 8-bit machines.

Improvements in Valdocs

Rising Star Industries recognizes this complaint and has attacked the problem

in several ways. First, version 1.18 has corrected some of the imperfections and bugs in the earlier software: the menus have been greatly refined and improved; a repeating vertical cursor control has been added; the text processor now automatically comes up in replace mode rather than in insertion mode; the STYLE and SIZE keys are now partially implemented (as mentioned earlier); and additional printer support is now provided. The so called "open manhole covers" through which data and files dropped from sight have been closed; I couldn't get the system to lose any of my files. The speed of operation has been significantly improved, but it still seems maddeningly slow in many cases.

During certain operations, this slowness is really operator perception rather than actual measured timing. The file handling operations appear to respond slower than equivalent CP/M procedures because CP/M keeps the user involved in the operation by forcing the entry of different commands throughout the process, while all Valdocs requires is a single keystroke. In addition, the speed increase of version 1.18 is effective only when operating under Valdocs. There is

no change in the *Creative Computing* benchmark values because Basic runs outside of Valdocs under CP/M.

Version 1.18 has expanded the capabilities of the earlier releases in many of the applications and file handling areas, thus making the system easier to use. For instance, the INDEX feature was limited to eight words per file, rather than the two-line, 16-keyword titles available in the current version.

Rising Star has also given the Valdocs user the ability to modify the text processor both to speed up its operation and to change certain of its characteristics. It is now possible to change the text mode so the cursor is not locked in the center of the screen with the text moving past it. The cursor can appear, instead, in the upper left corner and move through the text—a technique I prefer.

Further, by changing the Valdocs experience level from the lowest level (there are four levels: Beginner, Novice, Advanced, and Expert), you can access the Quirk function which allows the modification of the text screen to a character-oriented, as opposed to graphics-oriented, display. In this mode, the text processor is significantly faster, but is no longer capable of displaying the bold, italic, and other graphic styles. The characters are still printed as commanded, but they are not displayed on the screen.

One change in Valdocs 1.18 that is not an improvement becomes evident when

You can sit down at the QX-10, turn it on and immediately produce either a text document or excellent graphs without reading a single instruction.

you select the PRINT function. The number of lines left blank at the top and bottom of a printed page must be set in the printer parameter file using SETUP.SYS. But even when this value is set to 0, the printer supplies several linefeeds before printing. This is particularly bothersome when using single sheet paper.

Valdocs a Success?

The operation, success, and problems of Valdocs must be viewed from the perspective of the attempt to create an entirely new synthesis between the computer and the user. Rising Star Inc. 1985 Creative Computing Buyer's Guide

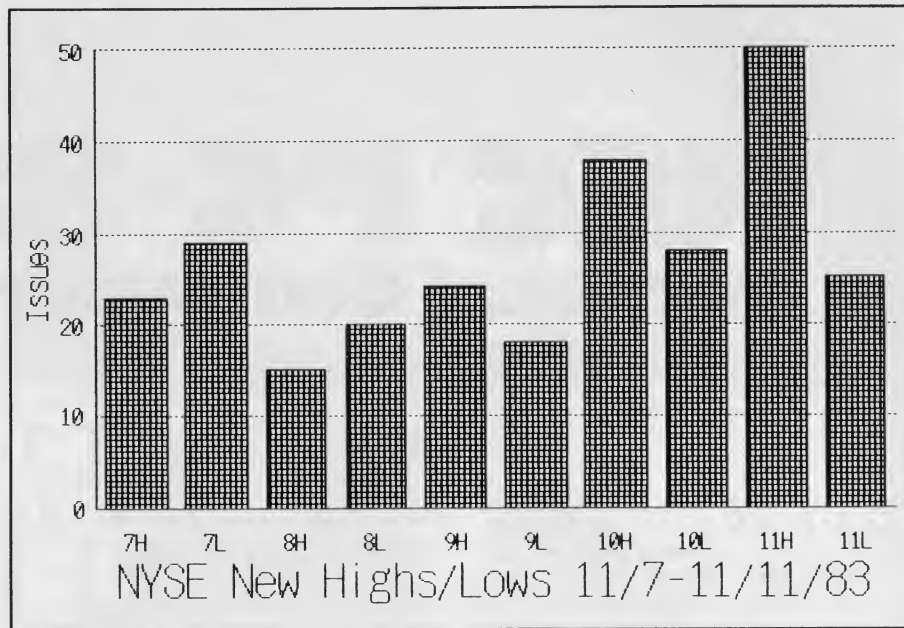


Figure by F. D. Williams

Through an interactive menu, the user may draw pie charts and bar, line, or scientific graphs.

industries intended to produce a user-friendly computer system supported by a logically designed dedicated keyboard, which can be used immediately by even complete computer neophytes without reference to the operating manuals. I think they have succeeded. Okay, a beginner will need to read the first chapter of the QX-10 Operations Manual to make sure the computer is correctly unpacked and connected and to learn which drive takes the operating system disk and which is for the data disk.

A first time computer user should read the simple first chapter to avoid some of the really dumb things that have been done: like stripping the outer jacket off the disks (after all, it is obvious that a square object can't rotate correctly, isn't it) or taking the disks to the photocopier to make backups.

Aside from this very preliminary education, there is almost no need for the manuals. You can sit down at the QX-10, turn it on and immediately produce either a text document or excellent graphs without reading a single instruction. Your operation may not be as efficient as possible, but it will be effective and catastrophe free. The philosophy of design as expressed by Chris Rutkowski is, "that which is not specifically prohibited is allowed," as opposed to most other computers which are based on the converse, "that which is not expressly allowed, is probably prohibited."

Version 2.x of Valdocs is intended to take an operating system which was essentially a proof of design offering and turn it into a system which minimizes some of the compromises involved in the first implementation. It is based on the

first thorough investigation of a user-friendly operating system.

In this next generation, in place of separate software modules, will be a package written as an integrated entirety, with consequent increased operating speeds. According to Rising Star, almost the entire Valdocs operating system has been rewritten; something less than 10% of the code from version 1.x has been retained. The HASCI interface is portable, so users will probably barely notice the difference in generations.

There is also a strong movement at Rising Star to ship version 2.x without any manuals at all, since the company thinks that many people are threatened by the manuals and documentation shipped with some systems. The new user thinks "Oh my gosh, does this mean I can't use this thing without reading 500 pages of computerese?" As I have attempted to make clear, this is definitely not the case with Valdocs; as mentioned earlier, even with version 1.18 a new operator can begin efficiently using the machine minutes after unpacking it.

The final stage (at least as now planned) in the evolutionary progress of Valdocs will be version 3.x, which will contain 95% of all applications software required of a business computer. Spreadsheet, database, and sorting capabilities will be added to complete the package.

All of these applications (and more) are available from the QX-10 under CP/M, but without the user-friendly overmind of Valdocs. If Rising Star and Epson can complete this ambitious undertaking, the QX-10 will take its place as the most user-friendly business computer on the market. **END**

CIRCLE 493 ON READER SERVICE CARD

NEC PC-8800

Personal Computer System

In the PC-8800, NEC Home Electronics USA has introduced a computer that belies their name. The PC-8800 is a professional business machine and hardly a home computer—although everyone who has seen it covets one for his home.

The bundled system is especially attractive as NEC has packaged together the keyboard, system unit, dual disk drives, monochrome monitor, CP/M

The PC-8800 must be considered a top contender in the small business market.

2.2, Microsoft Basic, *Multiplan*, *WordStar*, and *MailMerge* at an inviting price of \$1599. We have come to expect barely adequate documentation with many Japanese imports. Surprise! The documentation with the PC-8800 is absolutely outstanding. For these reasons and others we discuss below, the system must be considered a top contender in the small business systems market.

The Basic System

The bundled PC-8800 system comes in four cartons. The first contains the PC-8801A system unit (NEC calls it the "body") and a detachable keyboard.

The body is the heart of the system and contains the cpu, memory, interface circuitry, and I/O connectors. It measures 19.5" x 13.5" x 4.2" and makes a very suitable base on which to place the monitor.

On the front of the body is a pushbutton off/on switch (hurrah—no elusive rocker switch in the back), a recessed reset switch, a red power-on LED, and a green LED indicating the use of N88-Basic. More about this later.

David H. Ahl

Under the power switch is a 14-pin keyboard connector.

The rear is cluttered with every imaginable type of connector. Three DIN connectors are provided for the color display, monochrome display, and cassette recorder. It is unfortunate that the connector for the color display and cassette recorder are the same; this encourages confusion. D-type connectors are provided for a PC-8031A floppy disk unit, printer, and RS-232 device. A power cord jack rounds out the collection of exposed connectors.

Four bus expansion slots are covered by metal plates. It is into these slots that controller boards are inserted for the standard disk drives (8881A, 8882, 8831A, and 8832A), speech synthesis units, and other peripherals.

Also on the rear are two DIP switches and two jumper switches. These will

generally be set once and forgotten. They control such things as which Basic is operative, screen resolution, and communications parameters. They are thoroughly explained in the PC-8801A User's Guide.

Indeed, the entire system set up from unpacking through system use is illustrated and described in the User's Guide. This excellent 157-page manual should be the model for the industry; we have never seen better.

Ergonomic Keyboard

It is fashionable today for manufacturers to describe their keyboards as "ergonomic," whether they are or not. The one on the 8800 is. Character and number keys are matte finished in light gray while special keys are dark gray. The 92 keys are divided into three sections, a qwerty alphabetic section, numeric keypad, and a row of function keys. The keyboard measures 18.3" x 8.4" x 2.8" and plugs into the system unit by means of a coiled cable.



Bundled PC-8800 system set up for our evaluation.

The alphabetic portion of the keyboard is truly standard with shift, caps lock, and tab in the customary place on the left. Unfortunately, there is no LED caps lock indicator, something we have missed since the bygone days of the Teletype 33 and Sol 20. One extra key (underline) at the right end of the bottom row moves the right shift key slightly further to the right than one might expect.

The carriage return key is double size, and special symbols are on keys at the right of the alphabetic keyboard. We found it curious that although all of these extra keys produce two symbols (regular and shifted), six keytops displayed only one symbol.

Actually, each key on the keyboard produces up to four characters. These include the usual upper- and lowercase letters, numerals, and symbols marked on the keytops. In addition, if the GRAPH key is depressed, 56 graphics symbols can be produced. If the ALT key is depressed, the regular keys will produce an additional 64 Greek letters and mathematical symbols. In all, the 8800 has 212 built-in characters, all of which are accessible from the keyboard.

The numeric keypad at the right side of the unit has 20 keys for the ten numerals, arithmetic operations, comma, period, RETURN, HOME/CLR, and HELP. The HELP key is a great aid when debugging programs. When an error occurs during program execution, pressing HELP displays the statement and image where the error occurred.

The four cursor control keys are grouped next to the shift key at the right end of the keyboard. They are in a reasonably logical arrangement, although we prefer the diamond pattern on the portable NEC PC-8201 com-



The system has a truly ergonomic keyboard.



RETURN key is double size and cursor control keys are arranged reasonably.

puter. These keys, along with the INS/DEL (insert/delete) key, are used for on-screen editing of Basic programs as well as for cursor manipulation in other application programs.

In the top row of keys are STOP (halts execution of a program), COPY (causes the display on the monitor to be printed, assuming a NEC 8023A-C printer is connected), ROLL UP and ROLL DOWN (scrolls the text image on the monitor up or down), and five function keys.

Each of the function keys produces two functions, regular and shifted. In Basic, the default definitions are load,

run, auto, list, save, goto, key, print, edit, and cont. The keys can be user defined by means of the KEY statement. For example, KEY 1, "Creative" will cause Creative to be printed whenever Key 1 is depressed.

The system uses a responsive N-key rollover input which allows speedy, yet accurate entry for word processing and other applications. All keys repeat when held down for more than a half-second; but there is no audible keyclick to accompany key repeats.

On the Inside

The 8801A system unit uses an mpu equivalent to the Z80A running at 4 MHz. In our Basic benchmark program, the 8800 didn't break any speed records, posting times identical to the Apple II and Commodore 64.

The basic system is equipped with 64K of user RAM. It can be expanded to 128K with bank switching possible in 32K units. In addition, when N88-Basic is used, 48K of video RAM becomes operational.

HARDWARE PROFILE

Product: NEC PC-8800 Computer System

Type: Small business computer

CPU: 8-bit Z80A (optional 8086)

RAM: 64K included, 512K maximum

ROM: 72K

Keyboard: Detached, 92 full stroke keys

Text resolution: Up to 80 characters x 20 lines

Graphics resolution: Color 640 x 200 pixels, monochrome 640 x 400 pixels.

Colors: 8 primary, 60+ mixed



NEC PC-8800 bundled system includes system unit, keyboard, dual disk drives, and monochrome monitor.

Sound: One tone beep

Ports: RS-232 serial, Centronics parallel

Documentation: System manual, Basic manual and reference booklet, CP/M manual, manuals with each applications software package. Among the best documentation we've seen.

Pricing: Bundled system (see text) \$1599

Summary: Exceptional color graphics, excellent Basic, reliable and capable hardware and software. A remarkable system for the price.

Manufacturer:

NEC Home Electronics USA
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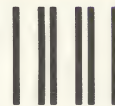
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A 32K ROM memory contains N-Basic and the monitor, while another 40K of ROM contains N88-Basic.

The system unit incorporates a NiCad battery to keep the time and date current once they are set. This is a very thoughtful touch, and one that is annoyingly absent on most other computers in this price range.

For those who need such information, the manual provides system block diagrams, a memory map, and pin-outs for all the connectors and the expansion bus.

Disk Drives

The standard disk drive included with the bundled 8800 system is the PC-8831A with dual double-sided, double-density, 5¼" drives. Alternatively, an 8" dual double-sided, double-density drive (PC-8881A) is available. Matching dual expansion drives can be added to both size drive units. For maximum economy, a dual single-sided, double-density, 5¼" drive (PC-8031A) is also available.

We tested the 8831A unit which is included with the bundled system. When formatted, each side of each disk stores 160K; thus the dual unit stores 640K on line.

The drive is reasonably compact, measuring 7.6" x 9.8" x 14.2". The power switch is awkwardly placed at the right rear. A dim, green LED on the front indicates when power is on. The drives should be powered up before turning on the system unit.

When power is applied to the unit, the drives do not rotate. The motor goes on only when a read or write operation is initiated by the computer. However, the drive then continues to spin for 2½ minutes, so subsequent disk operations are immediate and do not require a wait while the disk gets up to speed. If the

drive is not accessed for 2½ minutes, the motor shuts down. We judge this an excellent way to speed disk response time while saving wear and tear on the drive motor.

A red LED indicator on each drive indicates when a read or write operation is taking place; these lights glow at 20% of full intensity when the drives are in the standby state.

The User's Guide provides extensive illustrated instructions for using the drives; handling, formatting, backing up, and copying disks; loading N-Disk-Basic and N88-Disk-Basic; maintenance; and troubleshooting.



For our evaluation we hooked up an RGB color monitor simultaneously with the included monochrome monitor.

The disk drive is furnished with a system disk that contains both disk Basics, six utility programs, and four demonstration programs.

The bundled PC-8800 system has three additional disks containing CP/M 2.2 and the various applications software packages.

Output Display and Monitors

NEC is a major producer of TV sets and display monitors, so it should come as no surprise that the company offers a

choice of six monitors with the PC-8800 system.

As mentioned earlier, the one bundled with the standard system is the JB-1201, a 12" green phosphor monochrome monitor with resolution of up to 640 x 200 pixels. The monitor also has audio capabilities. Two pairs of RCA jacks are provided for video and audio in and out.

The front of the monitor has three controls for brightness, contrast, and volume. Five additional adjustments are provided on the back.

The monitor is tilted back at a 5-degree angle and has no provision for adjusting tilt or swivel.

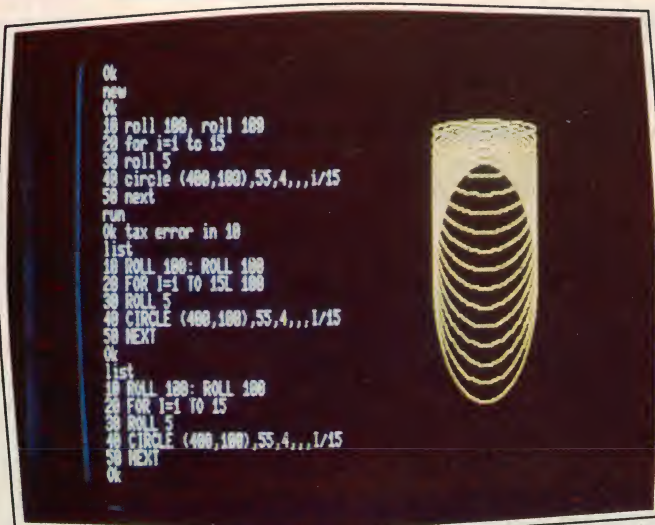
Economy 12" and 9" monochrome units are available, as well as an upper-end 14" unit with a resolution of 640 x 400 pixels.

Two color monitors are available. The top-of-the-line unit is the JC-1410, a 14" RGB monitor capable of displaying up to 640 x 400 individual pixels. A smaller, less expensive 12" RGB unit has a 640 x 200 pixel capability.

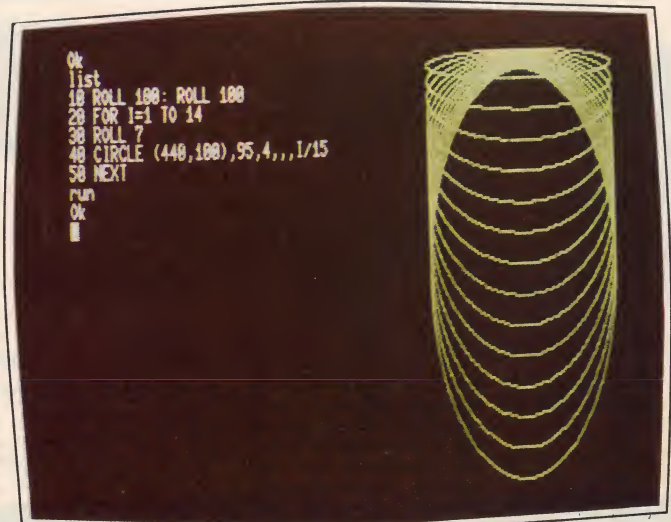
For many business applications, the 12" monochrome monitor is perfectly satisfactory. However, the computer is capable of producing spectacular, high-resolution graphics, and it seems a shame to waste this capability with a monochrome monitor. On the other hand, the price differential is \$600 or more—enough to make one think twice.

We tested the PC-8800 system with both the included monochrome monitor and a Toshiba high resolution RGB monitor attached simultaneously. For text, the monochrome monitor was slightly better, but for anything with color, the RGB unit was far superior.

The PC-8800 is capable of producing three text formats: 80 characters by 20 lines, 40 by 20, and 40 by 25. Characters are formed with a 5 x 7 dot matrix; de-



It is easy to debug graphics programs as the text screen and graphics screen are independent. Here, we have written a simple



four-line program to produce an image and then increased the radius of the circle.

scenders use one additional row of dots. With 20 lines on the screen, interline spacing is two rows of dots; this is reduced to one row with 25 lines on the screen. The descenders on lowercase letters use this spacing line, making readability very difficult in this format. All the application software we examined used the 80 x 20 mode with occasional use of the 40 x 20 mode for titles. In Basic, these modes are set by means of the WIDTH or CONSOLE command.

N-Basic has several additional text screen modes. It allows all combinations of 80, 72, 40, or 36 characters by either 20 or 25 lines.

The system discriminates between the text screen and graphics screen. Instructions in Basic are provided to alter each screen independently so that a change in one does not affect the other. This is a marvelous feature for writing and debugging graphics programs since the *graphics output remains on the screen* as the program is listed and changed.

The graphics screen is actually composed of three 640 x 200 pixel planes, each one of which can be controlled and set independently. Each plane corresponds to one of the three color guns: red, green, and blue. By combining these colors, eight distinctly different colors can be produced. However, by setting small groups of dots to different color patterns, it is possible to achieve some 60 different colors, hues, and patterns.

Data Recorder

The NEC PC-6082A data recorder is similar to a standard cassette recorder, but it is especially designed for consistent reading and writing of programs and data on tape. On the other hand, any standard cassette recorder can be used with the PC-8800. Default transfer rate is 1200 baud, but this can be set in

Basic to 600 baud for lower quality recorders.

The 6082 unit has the usual cassette recorder controls augmented by five program search buttons that help locate specific programs on a tape quickly.

Our judgment is that most PC-8800 users will use floppy disks as their primary storage vehicle. But for those who want cassette capability, it is available.

Powerful Basics

The NEC PC-8800 comes with two powerful versions of Basic, N-Basic and N88-Basic. Both can be used with and without disk drives. The N88-Basic is the primary programming tool of the PC-8800. It is a super-set of the original N-Basic with several extended instructions added to take advantage of the hardware.

We did all of our testing with N88-Basic as we believe the majority of PC-8800 users will choose to use that version. N-88 Basic is written by Microsoft and has all the familiar commands, statements, and functions. However, it has many additional capabilities, mostly having to do with graphics and files.

As mentioned earlier, three 640 x 200 pixel planes of graphics can be independently produced. The SCREEN command selects the desired plane(s) to be displayed on the screen.

The rich variety of available graphics commands are a programmer's delight.

File and device I/O commands are equally extensive and can reference three RS-232 devices, eight floppy disk drives, two cassette tape units, a lightpen, and printer. Three lightpen statements and one function are implemented for use with such a device.

Multiple program calls are supported with CHAIN, COMMON, and MERGE. Naturally, data can be passed to and

from programs using disk files. These files can be either sequential or random.

A pause command for which we have felt a need for years is finally implemented on the PC-8800. WAIT suspends program execution while waiting for specific input. Conversely, INPUT WAIT is used to accept keyboard input for a specified period of time. These are not the ultimate since they work only in conjunction with input, but combined with the real-time clock, they are a step in the right direction.

As we have come to expect, N88-Basic has full on-screen editing.

With a 64K machine, N88-Basic can use 56,799 bytes. This is twice the amount of free memory that can be used with Microsoft Basic on many other 64K computers; on such machines, Basic seems artificially limited to addressing 32K or less. N88-Disk-Basic can access 45,410 bytes in a 64K machine. Naturally, if files are specified, buffer space must be allocated which reduces the amount of free memory.

The only notable omission in N88-Basic is any sound capability. Well, perhaps we shouldn't say "any," since Basic does have the BEEP statement, but that is a far cry from three channels with a five-octave range.

Documentation

As mentioned in the opening paragraph, the documentation with the PC-8800 is nothing short of superb. We have said that the 157-page User's Guide should be the model for the industry. The same can be said for the Basic Reference Manual.

The 262-page CP/M manual is exceptionally comprehensive and, like the Basic manual, includes many examples illustrating the use of each command and utility program. It is the best CP/M



Program uses CIRCLE, LINE, and PAINT statements to produce an ever-changing display of "modern art." The first image is

shortly after starting the program; the second is several minutes later.

manual we have ever seen.

We are used to applications software manuals being prepared by the software producer with perhaps a sheet or two referring to the specific computer. Such is the case with the *WordStar* and *MailMerge* manuals. However, the *Multiplan* manual was specifically prepared for the PC-8800; this is a welcome change.

CP/M Operating System

Upon powering up the PC-8800 system with the disk drive on and the system disk inserted, the computer goes through a longish 15-second self check and disk load procedure, and finally comes up in Basic.

To get into CP/M, the CP/M disk is inserted when the system is powered up. After a shorter 8-second wait, the system comes up with the usual copyright notices and the A > prompt.

The CP/M disk contains 18 command files (sysgen, editor, pip, etc.), 14 device drivers (disk drives, RS-232, printer, clock, etc.), and four other files. It is a comprehensive library of utilities that allows the use of most of the capabilities of the system, except color graphics, as usual.

WordStar

The word processing program NEC has selected to bundle in with the PC-8800 system is *WordStar* by MicroPro International. This is a programmer's dream of a word processing system and has many features not found in other packages. On the other hand, it is not at all easy to learn and not at all what we would recommend for the occasional user.

The package comes with a single disk, formidable 200-page manual in a three-ring binder, reference card, 26 keytop stickers, and a single sheet indicating the functions of the various keys on the NEC keyboard.

Multiplan

Multiplan is the spreadsheet program by Microsoft that some users swear by and others swear at. It has several improvements over the granddaddy of spreadsheets, *VisiCalc*. However, because of its extended features, many operations and entries require more keystrokes than *VisiCalc*.

On the other hand, on the bottom of the *Multiplan* screen is a short explanation of the various commands; this aids in learning and using the system. A HELP command, which brings in additional help information from the disk, is also available. One very unhelpful thing is that the CP/M labels for the function keys remain displayed on the bottom row of the screen; they are not

implemented under *Multiplan* and cause an error if pressed.

Like *WordStar*, *Multiplan* is a favorite spreadsheet of hard core programmers because of its extended capabilities; however, it is more than satisfactory for the occasional user as well.

Communications

The PC-8800 system includes a powerful terminal program built into the ROM. Since the system includes a standard RS-232 serial interface, with the addition of a cable and modem, the PC-8800 is ready to do duty as a communications terminal.

Terminal mode can be entered in two

We'll take the system as is; at the price it is a remarkable performer.

ways. From Basic, the TERM statement allows the selection of communications parameters. Once entered, the computer automatically acts as a terminal.

If you expect to use the computer mainly as a terminal, the DIP switches on the back can be set to enter terminal mode automatically upon powering up the system.

In either terminal mode, function keys 6-10 are redefined to allow the entry of control codes, select half or full duplex, dump the screen to the printer, and copy data from the buffer. The manual describes the use of terminal mode thoroughly including remote Basic protocol.

Other CPU And Peripherals

In addition to the system components described above, eight expansion boards are available for the computer. Perhaps the most interesting board is one containing a 16-bit 8086 microprocessor. Presumably, with this board the 8800 would be able to run IBM PC software as well as many of the emerging 16-bit packages. Details were not available about this board at the time of writing this review.

Two memory boards are available, one with 32K and the other with 128K in four banks of 32K each.

A serial communication board has two serial ports for different types of synchronous (bisync/SDLC/HDLC) and asynchronous protocols. This board will allow communication with IBM and other mainframes.

A voice synthesis and voice recognition board each contain their own cpu, memory, and special chip set for speech synthesis or recognition.

Last, for engineers and designers, a universal board, which can contain up to 32 wirewrap IC sockets, is available.

Pricing

The PC-8800 bundled package includes the computer with 64K, dual 5 1/4" disk drives, monochrome monitor, both Basics, CP/M, *WordStar*, and *Multiplan*. The package price is \$1599, roughly \$1000 less than the individual items purchased separately.

The high-resolution RGB color monitors are somewhat pricey; the 14" one costs \$998 and the 12" one, \$599. The 12" monochrome monitor with the bundled system is \$199 by itself; a less expensive unit is available for \$149.

The PC-6082A data recorder costs \$100. The bundled 5 1/4" dual floppy disk drive costs \$1099 separately while an 8" dual drive costs \$1999.

The 16-bit 8086 mpu board costs \$595 and a 32K RAM costs \$250.

Most of the above items are generally not discounted.

The list price for the NEC PC-8027A printer is \$499.

Although the bundled system at \$1599 is an excellent value, if one were to add a color monitor and printer, the price would jump to around \$3000—still a relative bargain. The 16-bit mpu and more memory would bring the price to over \$4000, still generally in line with other systems with the same or less capabilities.

The Bottom Line

As is probably obvious by now, we are most enthusiastic about the NEC PC-8800 system. It has exceptional color graphics capabilities, an outstanding version of Basic, and a nice complement of included software. The computer has been available in Japan so the bugs are ironed out, and the system should have high reliability. It is an excellent value at the package price of \$1599.

At the moment, there is not a great deal of packaged software for the PC-8800 system (unless you can read Japanese). Although there is a wealth of software that runs under CP/M, it must be recorded onto NEC disks and configured to use the NEC hardware. This can be done by downloading with the terminal package, but at the moment it must be done by you, the customer, assuming you want any packages beyond the included Basic, *WordStar*, and *Multiplan*. We have been assured by NEC that a great deal of additional software will be available before long, and we have no reason to doubt them.

As for us, we'll take the system as is; at the price it is a remarkable performer. END

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Eagle PC Plus 2

The Eagle PC Plus 2 consists of a detachable keyboard, systems unit with two low-profile disk drives, monitor, software and documentation.

The Eagle PC is a versatile and powerful small business computer system. As its name implies, it is an IBM PC compatible system, but it is much more. Bundled with it are MS-DOS and BasicA.

The Eagle PC is available in three configurations ranging from a 128K unbundled system to a top-of-the line version with a 10Mb hard disk. We tested the PC Plus 2, the configuration we judge will be the choice of most users. It has 128K of RAM, two floppy disk drives, monochrome monitor, MS-DOS, and BasicA.

Physically, the system consists of a system unit with low profile floppy disk drives, detachable keyboard, and monitor. The documentation and software are contained in one three-inch thick, three-ring binder. The hardware components are finished in a handsome light and dark gray color scheme.

Setup and installation are straightforward and simple. The coiled cable on the keyboard plugs into the back of the system unit. The power cord and video

David H. Ahl

cable from the monitor also plug into the system unit, and that's it. When it is not in use, the keyboard slides into a keyboard encasement under the system unit,

thus giving it a space-saving footprint.

Detachable Keyboard

The keyboard is a sculpted unit which attaches to the system unit with a coiled cable which has a reach of four feet. Thus it is suitable for desktop or lap operation.

HARDWARE PROFILE

Product: Eagle PC Plus 2
Type: Small business computer
CPU: 16-bit 8088
RAM: 128K, 512K maximum
Keyboard: Detached, 84 keys
Graphics resolution: 320 x 200 pixels with optional color board
Ports: Two RS-232 serial, Centronics parallel

Text resolution: 25 lines x 80 characters

Disk drives: Two double sided, double density, 5¼" drives, 360K each

Software: MS-DOS, BasicA included

Documentation: User's guide, and manuals for BasicA

Price: \$2495; monitor extra

Summary: An IBM compatible system with many extras.

Manufacturer:

Eagle Computer
 983 University Ave.
 Los Gatos, CA 95030
 (408) 399-4200

The keyboard contains 84 full-stroke keys. The standard alphanumeric keys and numeric keypad are white; the remaining keys are dark gray.

The keys are arranged in a more-or-less standard pattern—certainly more standard than the IBM PC. A nice touch is the separate shift lock (acts like a standard typewriter) and alpha lock (shifts only letters—very handy for word processing).

Special keys include the expected ESCAPE, CONTROL, ALT, INSERT, DELETE, BREAK, and HOME. In addition, there are keys marked ENHANCE and HELP (implemented in some software packages), four cursor control keys (arranged in a logical pattern), and 10 programmable function keys. Unfortunately, the left cursor and backspace key are one and the same, i.e., it is a destructive left cursor. We prefer separate keys.

The keyboard has an excellent feel and keybounce is nonexistent. All keys repeat after being held down for about one second. There is no audible keyclick on repeated characters, so you must watch the screen to get the desired number of repeats.

System Unit and Disk Drives

The system unit houses the cpu, memory, I/O circuitry, disk drives, and expansion slots. The mpu employed is a

Computer	Time	Accuracy (Lower is better)
TI Professional	0:15	.005859375
Eagle PC-2	0:19	.005859375
IBM PC	0:24	.01159668

Table 1. Benchmark comparisons.

16-bit 8088 running at 4.7 MHz. Its performance on our benchmark was about as expected falling between the TI Professional and the IBM PC (see Table 1).

The PC-2 has 128K of RAM, expandable to 512K. With the exception of a bootup procedure, nothing is contained in ROM, hence, applications software packages tend to eat up large chunks of memory. This, of course, is no different from other machines in this category, but quite different from low end and notebook computers which have Basic and sometimes other software contained in ROM.

Two low profile, double-sided, double-density floppy disk drives each with a capacity of 320K are built into the PC-2. We like the quarter-rotation handles which raise and lower the drive spindles and hold the disk in the drive; we find them more reliable than the flimsy doors on the IBM PC (and many other computers). In operation, the drives are

exceptionally quiet.

Indeed, the system itself is noiseless (no noisy fan like the TI Professional, although we understand that TI dealers will replace the airplane turbine in earlier units with a new, quiet fan). To see if overheating might be a problem, we operated the Eagle in a room heated to 90 degrees and left it running for 24 hours with no ill effects. After 24 hours, the system unit was quite warm, but it still was executing our program flawlessly.

The PC-2 system unit has connectors for the keyboard, monitor (D-9 jack for Eagle monitor and RCA jack for others), two RS-232 serial devices, and a parallel printer. The printer output is to a female Centronics-type connector, the same as on most printers. We had some difficulty locating a cable with a male Centronics connector on both ends, but as this convention is employed by more computer manufacturers (Epson, Fujitsu, etc.), we expect cables to be more readily available.

The built-in character set is quite rich.

The system unit also has four slots for IBM-type add-on boards. In the PC-2, one of these slots is already occupied, so three are available.

Output Display

The PC-1 and PC-2 configurations both include a 12" green monochrome monitor. We like the power cord that plugs into the system unit allowing the entire system to be turned off and on with just one switch. Text resolution is 80 characters by 25 lines. Characters are formed within an 11 x 14 pixel matrix and are very legible.

The specifications for the monitor state that it has 720 x 352 pixel graphics resolution. However, this is moot, as graphics are not supported by the monochrome video board.

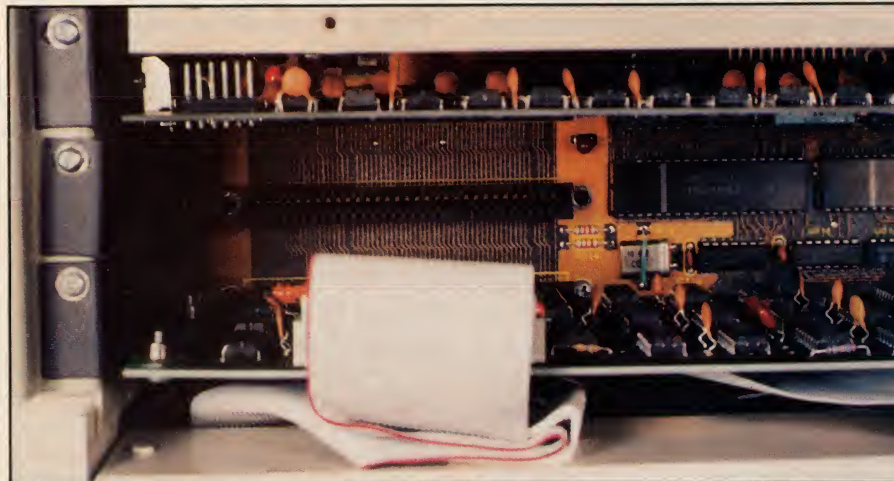
The built-in character set is quite rich and provides 222 printing characters; these are, of course, the same ones found on the IBM PC. They include the expected ASCII letters, numbers and symbols, 50 graphics characters, 37 foreign letters, 17 Greek letters, math symbols, and several other strange characters.

A medium-resolution color board (320 x 200 pixels) is available for use with any good quality RGB color monitor. This board allows the use of the graphics commands in BasicA as well as the running of machine language programs that employ color graphics.

1985 Creative Computing Buyer's Guide



The keyboard has 105 full-stroke keys. The top and bottom rows contain 24 programmable function keys.



Four IBM PC compatible slots are available for peripherals; in the photo, two boards are plugged in.

BasicA

Microsoft BasicA is included with the Eagle PC. This is the standard 8088 Basic interpreter that runs under MS-DOS. It has all the bells and whistles with the exception of the graphics commands which require the optional color board.

The disk comes with a User's Guide and Basic Reference Manual.

IBM PC Compatibility

The Eagle PC is promoted and sold as an IBM PC compatible computer, and indeed it is. All you do is pop in an IBM PC disk, power up the Eagle, and you are off and running. It is that easy! We didn't try every possible program, but all the ones we tried ran without a hitch.

Documentation

As mentioned earlier, all the manuals for the Eagle PC are contained in one large three-ring binder. The manuals include a 78-page User's Guide and manual for BasicA.

Warranty and Support

The Eagle PC comes with the usual 90-day limited warranty on parts and labor, plus a one-year warranty on parts.

Service on the hardware is available from either the selling dealer, Bell & Howell (a third party maintenance organization with 175 service locations), or directly from Eagle in Los Gatos.

Software support is also available from your local dealer, from regional distributors, or directly from the Eagle Customer Service Organization. You can hope you don't need to use this last option. We tried calling the distributor that shipped us the computer and they gave us a toll-free number to call at Eagle. It produced only a recorded announcement that it was inoperative.

We then called long distance—several times—and left messages. Finally, one was returned by a charming young lady who asked if we really had a problem. We said, "Yes, why do you think we called?" She said, "Okay, then I'll have a customer service person call you back." None ever did.

When testing a computer, we like to act as a normal customer, but after a month we gave up, revealed our true identity, and got some fast response to our problems.

We understand that things have improved today, so we tried the customer service line just before putting the finishing touches on this article and were rewarded with a return call in about two hours. We judge that quite acceptable.

Pricing

As mentioned above, the Eagle PC-2 with 128K, two disk drives, MS-DOS, and BasicA lists for \$2495. Options include a 1985 Creative Computing Buyer's Guide

64K memory kit (\$95) and color board (\$295).

The Eagle PC Plus XL includes a 10Mb hard disk and one floppy drive; price is \$42.95.

In Summary

The Eagle PC is a well-designed computer with plenty of power and good versatility in a space-efficient package. The keyboard uses a standard layout, has a numeric keypad, and 10 function keys. The disk drives are very quiet and,

when the drives are not in operation, the system is totally noiseless.

Our experience with the customer support group wasn't wonderful, but that seems to have been rectified. This is a small nit against a machine that is excellent in nearly every regard.

Considering the IBM compatibility, included MS-DOS and BasicA, expansion slots and compact design, we find ourselves in agreement with Eagle when they say, "The Eagle PC is simply, a better PC." It sure is. END

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CIRCLE 112 ON READER SERVICE CARD

Cromemco C-10



A Small Business System for a Reasonable Price

Updated software for the C-10, delivered to us as we went to press, appears to offer significantly improved performance. This review will give you a good feel for the system, but be sure to ask for a demonstration of the latest software before you buy.

The C-10 is the latest entry from Cromemco, one of the oldest and most respected manufacturers of small business-oriented computers. This addition to the low end of Cromemco's line represents a good value at \$1785 for a bundled package of hardware and software. It also has some excellent features, and a few not-so-excellent ones. Let's have a look and see whether it might be the computer for you.

Display

The CRT is a 12" unit coated with P-31 phosphor. The image delay provided by the P-31 is one of the best features of the C-10. The character display is 25 lines of 80 characters each.

There are four character sets in ROM, but the documentation lacks any instructions on how to get to them. The pixel graphics mode provides a display of 160 x 72, and full graphics mode offers 720 x 384.

The character display is very clear in the center of the screen, bleeding to a slight fuzziness around the edges. The

David Hilton

edges of the screen display also contract about $\frac{1}{8}$ " each time the disk drive is accessed.

CPU

The heart of the computer is a Z80 microprocessor with a 4 MHz clock. The standard configuration includes 64K of RAM and 24K of ROM. Resident in ROM are a disk boot routine, self-test routines, and the CROS, a firmware resident monitor.

The main system unit sports a disk interface port, an RS-232 port with a DB25 connector, a computer port with a DB9 connector, and the keyboard port, which uses a telephone type plug. The unit is not portable in that it does not have handles, but it is certainly light enough to be transported from place to place when necessary.

Keyboard

The keyboard that is supplied with the C-10 is also lightweight and compact. The two rubber-tipped bolts which are provided as height adjusters are inadequate, however. As the keyboard is used, the bolts revolve and the unit creeps away from the user. And since they do not revolve in unison, they soon get to be different lengths, which causes

the keyboard to rock.

I solved the problem by threading a nut onto each bolt and using it as a lock-nut to hold the bolts in place. I also glued a piece of rubber to the bottom of the keyboard case to help hold it in place on the desktop.

HARDWARE PROFILE

Product: Cromemco C-10

Type: Business-oriented computer

System: Z80A, CDOS, 64K RAM, 24K ROM

Specifications: 12" x 10" x 16", 25 lbs.

Performance: Fair because of slow disk drives.

Ease of Use: Very good with some software packages.

Documentation: Adequate

Summary: Reasonably priced CP/M system.

Overall Mark: Fair to good

Price: \$1785

Manufacturer:

Cromemco
280 Bernardo Ave.
Mountain View, CA 94039
(415) 964-7400

The key configuration is the normal QWERTY with some added features. There are four cursor control keys in the lower righthand corner. The TAB key is immediately above them. DELETE is in an unusual, but not awkward, position to the right of the spacebar. ESC is next to the Q. Below it is CONTROL (in red), and below that in the normal position is the SHIFT key. ALPHA LOCK is below SHIFT.

The equivalent of function keys is achieved by striking combinations of the number keys, CONTROL, and SHIFT.

Other customizable features include toggling of the audible click and changing the rate of auto-repetition. The M, J, K, L, U, I, O, 7, 8, and 9 keys can be made to function as a numeric keypad simply by pressing CONTROL-SHIFT-N, and the SHIFT key produces lowercase letters when the ALPHA LOCK is engaged. There is an undocumented status line which appears at the bottom of the screen when CONTROL-SHIFT-S is pressed.

Disk Drives

The disk drives are double sided, double density 5 $\frac{1}{4}$ " drives with a storage capacity of 386K each. They are reasonably quiet and generate very little heat. The system can accommodate a maximum of two drives, and the operating system automatically senses the number of drives attached. All of the software packages tested worked equally well with either one or two drives.

Other Hardware

The CLQ is the letter quality printer Cromemco sells to complement the C-10. It is nothing fancy, just a solid, reliable printer, which represents a good value for the \$795 retail price.

The optional second disk drive sells for \$595, an average price for additional drives.

Documentation

All information about the C-10, CROS (Cromemco Resident Operating System), and CDOS (Cromemco Disk Operating System) is provided in the 170-page user manual. The sections on setup are excellent, and there are very nice examples to follow for using the utilities and a glossary and index for quick reference.

The manual provides 35 pages of setup information along with some good advice on the proper care and feeding of a computer system. This information, along with a set of unique cable connectors, removes the guesswork from the setup procedure.

Some topics, however, are simply ignored by the manual. For example, when you do a DIR on the distribution

disk, you see EWS as system attributes. In the attribute command section of the manual, E, W, and R are described; S is not. All of the hardware and software manuals associated with the system suffer from the fact that the development of the system and applications software has outstripped the documentation. Hence, there are many undocumented features.

The user manual is devoid of technical information. Cromemco apparently assumes that the average C-10 user will neither need nor understand the details of the inner workings of the machine. A technical manual is available to dealers and owners who specifically request it.

Software

Software for the C-10 is of four types: ROM code, operating system, operating system facilities, and application packages. As mentioned above, CROS is contained in 24K of ROM. It provides for

The damning question is: why do the Master programs jump outside of themselves so often?

examining and changing the contents of memory, reading and writing to the I/O ports, reading and writing to physical locations on the disk, booting CDOS, executing programs at the machine code level, and running system test routines. CROS also provides the user with the ability to configure the I/O port connection so the C-10 can be used as a terminal. CROS does not have a debugging facility or any assembly language features.

Also contained in ROM is the system initialization sequence, which is run when the computer is turned on. Part of this sequence sets the contents of RAM to EF hexadecimal, which is a processor "Restart 5" opcode which causes the Z80 to branch unconditionally to memory location 28 hex. This RST 5 is the mechanism for activating a feature of the C-10 which the user sees all too often while running *PlanMaster* and *WriteMaster*: the System Trap.

Like a wumpus in its cave, this cold-hearted critter lurks within the functions of the Master series. The Trap is activated when the processor tries to execute an instruction outside of the body of the currently running program. This is fine. It protects the user from some strange results when things run amok.

The damning question is: why do the Master programs jump outside of themselves so often?

The machine code seems to have some basic fault that causes it to try to execute outside itself. Like the safety on a firearm, this sort of safeguard is nice to have, but you should not have to rely on it. The operation of the Cromemco C-10 depends on the System Trap.

CDOS

CDOS is a CP/M look-alike written by Cromemco specifically for their Z80-based machines. Like CP/M, it includes resident commands: DIR, REN, TYPE, ATTR, *, PRINT, and L. DIR and L both provide a list of the files on the current disk. File size and remaining free storage is displayed at the end of the file list.

REN and TYPE are the same as their namesakes in CP/M. ATTR is unique to CDOS; it allows the setting and resetting of file attributes; E for erase protect, W for write protect, R for read protect. The aforementioned undocumented S is said to be programmer specifiable.

The * command runs the utility called Menu, about which more later. The CONTROL-P printer toggle function of CP/M is duplicated in CDOS in addition to the PRINT command which is identical to TYPE, except that text appears on the printer rather than the screen. These resident commands and any runnable program may be specified to CDOS in upper- or lowercase.

CDOS has the built-in capability to execute a program at boot time. The mechanism is a special case of the BATCH command: any time CDOS is run, it looks for a file named STARTUP.CMD. If one exists, CDOS processes it.

There is partial compatibility between CDOS and CP/M. The manuals do not list the conditions which determine it, so compatibility must be determined empirically.

Menu

Menu is the utility that forms the heart and soul of the C-10 for the beginning user. CDOS automatically runs Menu when the computer is turned on (after looking for STARTUP.CMD), thus insulating the unsophisticated user from the operating system. Two screens offer the user 18 choices of programs to run. A program not on the menu may be run by typing in its name instead of a menu selection number.

If a program is entered from the menu, CDOS returns to Menu when the program exits the system. Sometimes the Master programs like to return to Menu when they are not supposed to—that is, when they don't feel like taking the user through a System Trap. I found it necessary to erase the Menu program from

the disk to shorten boot time and eliminate the penalty for reloading Menu after each command.

CopyDisk

CopyDisk formats and moves the system tracks to a new disk, copying the contents of the data tracks as an exact image of the source disk. It cannot copy without first going through the formatting and sysgen stages, however. This means that every disk in use has the system tracks active and that disks are reformatted often.

There is no real problem with this procedure except that it means that the total time required to run CopyDisk is well over seven minutes. In a single drive system, it takes even longer, because the user must physically change disks for each of the nine passes that it takes to copy the whole disk. The whole process is entirely too time-consuming to be practical.

Fortunately, there is another utility provided for file copying. CopyFile performs the same disk-to-disk file transfer functions as the PIP program in CP/M. Wildcards are allowed, and files can be copied in both single and dual drive systems. CopyFile is a nicely written program that can be invoked with a parameter string. It does, however, offer the necessary prompting if it is invoked without parameters. It is one of the nicest programs in the system.

ChekDisk

ChekDisk performs two functions. First, it can be used to check for overlapping files. The documentation states that if overlapping files are found, ChekDisk will inform the user of the appropriate corrective action. I was unable to verify this statement, because I never presented

the system with an overlapping file.

The second function of ChekDisk is to read the complete disk while checking "disk integrity." I assume that this means it is checking for bad formatting, bad address mark CRC errors, and bad data mark CRC errors. I was unable to verify this as well. The only error message I ever got from ChekDisk was: Home error: Driveb:, Cylinder, Surface 00, Sector 0a, Status-34. I subsequently erased ChekDisk from all but the distribution disk.

Batch

Batch allows you to string together as many lines of CDOS level commands as you want. These commands are then processed without any further interaction with the user. The user can create files with the extension .CMD as lists of these CDOS primitives for future or repeated processing. Batch is not included in all releases of CDOS.

Printer

Printer is an interactive program which sets up the assignments for the logical printer. It has pre-defined selections for a variety of printers, both parallel and serial. This is somewhat confusing as the C-10 has only a serial printer port.

Structured Basic

Beginners won't get into Structured Basic very often, but for anyone who has ever wanted something extra in his Basic, it is here: Tracing, built-in editing, Boolean operators, long and short floating point, while-end-while, extensive output formatting, extensive I/O driver control, partitions, procedures, error handling, external library functions, the list goes on and on—long enough to sat-

isfy the desires of any Basic programmer. The 311-page Structured Basic manual contains everything a user needs to know about the language as well as the only clues about the insides of the C-10 that you can find in the standard documentation.

Bright

The normal video display of the C-10 consists of light characters on a dark background. Both the intensity of the character display and the intensity of the background can be varied over a scale of 16 settings.

Some of these settings are not very useful. Having both foreground and background at the same setting makes the characters hard to distinguish. On the other hand, the display can be tuned to whatever brightness and contrast suit the eyes of the user and the ambient lighting. Bright is the utility that makes this possible.

Screen

The user who wishes to enter text into the C-10, either as a document or as a source code file for a language, has a choice of two text input systems, *WriteMaster* and *Screen*. *Screen* is a quick, clean, and delightful two-dimensional screen editor. It is several notches above the typical line-oriented editors often distributed by manufacturers but not quite equal in complexity or functionality to a full blown word processor.

Screen is the best all round "standard equipment" editor I have seen. It maintains a banner across the top line of the display which shows all the available options. As an option is chosen, the banner changes to prompt the user for the correct input for that option.

Screen is also clever enough to protect the unwary user who creates a file that is too large for the available disk space. Left and right margins as well as paragraph indentations are selectable, and the *BEAUTIFY* command reformats the text. *Screen* is another of the good things in the C-10 package.

MoneyMaster

Now we come to the biggies, the Master series: *MoneyMaster*, *PlanMaster*, and *WriteMaster*. *MoneyMaster* is a Basic program. It is also the one true application program in the C-10 system. It performs six financial analysis functions:

- Stock market analysis
- Stock buy price analysis
- Bond yield-to-maturity analysis
- Bond buy price analysis
- Real estate after tax yield analysis
- Equipment purchase time until break-even analysis

Each analysis is branched to from an 1985 Creative Computing Buyer's Guide



opening menu. All necessary input for each routine is prompted for and error checked. Allowances have been made for inconsistent input structures; where a dollar amount is expected, for example, the program doesn't care if a dollar sign is typed or not. It is, however, possible to overflow the capacity of the program for handling out of range numbers. If this happens, the program bounces the user back to CDOS.

MoneyMaster is useful for getting a sense of the growth or diminution of an asset over time.

PlanMaster

PlanMaster is Cromemco's electronic spreadsheet for the C-10. The user of *PlanMaster* works within a fixed structure which is made up of ten *plansheets* each of which is limited to 31 rows and 13 columns. The user may choose as many of the ten plansheets as he wishes for each plan. He may also choose the number of rows and columns that best fit his data.

The rows and columns always appear on the display, but when the matrix is printed out, only the labeled ones are printed. Columns can range in size from four to 16 characters wide, and each column can be declared to contain hexadecimal, normal, or scientific numbers. In normal and scientific modes, the user can select the number of decimal places from the range zero to six.

Each of the ten sheets in each plan can have one and only one *define screen*. The user must design the plan so that he will never need more than 24 lines of calculations for each 13 x 31 sheet. Fortunately, cell values can be passed between sheets in a single plan. If the definitions calculate a number too large for the size field selected, *PlanMaster* places ##### in that field on the sheet and offers the user a chance to widen the field.

The program is easy to use for those whose requirements fit within the limitations it sets forth. *PlanMaster* is, however, a flaky program. It hangs, for example, if too many column widths are changed without saving the format, and it sends the user to the System Trap under circumstances that cannot be consistently reproduced. Occasionally, it copies either too much or too little information back and forth between sheets in a single plan. Sometimes it fails to read back in the data and format files that it has just written out.

I suggest that those who choose to use it follow the instructions contained in the Help functions, as they are more correct and current than those in the manual.

PlanMaster is suitable as a tool for learning about spreadsheets. Its simple 1985 Creative Computing Buyer's Guide

form allows for a steep learning curve for the first time user. I suspect, however, that anyone who is serious about using an electronic spreadsheet will want to look elsewhere.

WriteMaster

By far the most worthwhile program in the C-10 package is *WriteMaster*.

WriteMaster abounds with helpful little features which by making the program more forgiving of the user's mistakes, makes him more forgiving of its mistakes. For example, if the user runs out of disk space, *WriteMaster* displays the disk directory and leads him through a deleting session that allows him to clear sufficient space to save his text.

In edit mode, single keystrokes produce boldface, underlining, and centering.

Among the most useful functions included in the program are the FIND and

WriteMaster includes several features which are provided as extra cost options on other word processors.

REPLACE commands. Using FIND or REPLACE causes the 24 "function keys" to be redefined temporarily for special use within those commands. Wildcards are allowed; (ANY CHAR f1);ANY SEQUENCE, for example, finds a string when given only its beginning and ending characters. SET SEARCH sets sensitivity to upper- and lowercase and sets up conditional groupings of characters to look for. NOT causes the conditions that have been set for the search to reject a string from a search rather than include it. With combinations of these functions, the user can perform such tasks as looking for all three-character words that begin with t but do not have e, a, or t as their third letter.

WriteMaster includes several features which are provided as extra cost options on other word processors. Merge, for example, allows the user to pick names from one file and insert them in a form letter contained in another file. *WriteMaster* is used to set up both the boilerplate and the data file. The merged stream may be displayed on the console, sent to the printer, or saved back on disk.

Another useful command for those who write books and long papers is the INDEX command and its companion MARK-FOR-INDEX. Used together, these

two commands can build an alphabetized index with page number references. This index is appended to the user's file and can be edited just as normal text would be edited.

WriteMaster also has the best documentation in the package.

Summary

The C-10 is a mixed bag. I gathered the information for this review over three months, during which time I was given four releases of the operating system and two different C-10 computers. Why so many changes? Because I was getting all sorts of strange results from the system. Many times while using *WriteMaster* and *PlanMaster*, the system would hang, hit the System Trap, garble and display, destroy my file, or retrench to some lower level of code on the operating system.

I did observe steady improvement through the later releases of the software, but I cannot ignore this general instability in the system. I do not nor do the people with whom I have spoken at Cromemco know just how many of the problems I experienced are bugs in the software and how many are attributable to hardware failures. Certainly, the latter part of the review process, after the original system had been replaced, went much more smoothly than the first part.

As far as I am concerned, *WriteMaster* is almost reason enough to buy the machine. Structured Basic and the Screen utility offer the user who wants to write his own software enormous power. For these people, an assembler and additional languages are available as extra cost options.

It is a shame that *PlanMaster* falls so far short of the quality of the rest of the system. It is definitely the poorest program in the package.

The C-10 is also in desperate need of communications software, not only of the modem hookup variety but of the system-to-system-through-serial-interface-variety. I sat here for over two months with four other computers within arm's reach and several hundred floppy disks and tapes full of software but no way to get any of it into the C-10.

Conclusion

When I was a little tyke, one of my favorite stories was "The Little Engine That Could." I thought of it as I watched one of the high-resolution graphics demos on the C-10: a train was chugging its way across the screen with smoke pouring from its stack and the whistle blowing. It occurred to me that the C-10 is like that little train... if it could just throw off some of the dead weight and get up a little more steam, it could make it to the top. END

A Low Cost Desktop System

Morrow Micro Decision



With the MDT20 optional terminal resting above the computer enclosure, the Micro Decision bears a striking resemblance to IBM's PC. But at two-thirds the price it is a little easier on your pocketbook.

Laurie Baggiani

Unlike skyrocketing food prices, prices in the computer marketplace con-

tinue to fall. It's not so surprising, therefore, that George Morrow, founder of Morrow Designs, Inc. has adopted the phrase "more for less" in advertising his newest line of desktop computers named the Micro Decision.

There is no doubt the phrase aptly describes the Micro Decision, which is a powerful CP/M-type computer based on a single printed circuit board design. The basic two-drive system (MD2, as it is called) includes an 8-bit, Z80 main processor with 64K of memory, two serial ports, one parallel port, a green phosphor terminal, seven bundled software packages, and two 5¼" double density, floppy disk drives (storing 200K each)—all at a retail price of \$1699.

These features alone, however, don't make the Micro Decision unique. After all, low-cost systems with bundled software have been on the market for a while, most notably in the humbled Osborne 1 and its close rival, the Kaypro II. What *does* make the Micro Decision special is being the first *desktop* offering in this class, along with several distinctive features designed to make CP/M-style computing less threatening to the computer novice.

One feature especially welcomed by neophytes is Morrow's Micro Menu, a menu driven front end to CP/M 2.2, which provides a gradual introduction to

1985 Creative Computing Buyer's Guide

HARDWARE PROFILE

Name: Micro Decision

Type: Desktop

CPU: Z80A (4 MHz)

RAM: 64K

ROM: 2K

Type of keyboard: 8 cursor control keys, 7 programmable function keys, detachable, 92 keys, 14-key numeric keypad

Text resolution: 80 x 24

Graphics resolution: 9 x 12 dot matrix

Number of colors: Green phosphorous

Sound capability: None

Ports: 2 RS-232C serial ports,
1 parallel port

Dimensions: 5.3" x 16.7" x 11.3"

Documentation: Good user manual,
Pilot very good

Summary: A reliable CP/M computer.
Good for novice and expert alike.

Price: \$1699

Manufacturer:

Morrow Designs
600 McCormick St.
San Leandro, CA 94577
(415) 430-1970

popular and somewhat legendary operating system. Described as "your road map through CP/M," the menu lets you access six of the applications programs provided with the unit, or select a utility menu for help in performing one of the most common CP/M utilities.

Clear, concise, on-screen directions, like commands like formatting a disk, copying and renaming files, as easy as following a recipe—regardless of your level of computer expertise. Conveniently, too; once you become adept at working within CP/M, the menus can be deactivated, restoring the standard CP/M level of operation.

Another nice feature for beginners is the on-line tutorial which can be accessed via the Micro Menu or directly from the CP/M prompt. The CP/M tutorial provides explanations of all of the fundamental system commands such as A, REN, DIR, STAT, and SYSGEN, along with brief illustrations of the conveniences required to use them.

I grant you, this is not a fancy 16-bit machine. Nor is it time-sharing, multi-user, or dual-processing, with inexpensive I/O expansion. But as an entry level, CP/M-based computer, it has a rather impressive array of hardware and software to offer, for the money.

density disk drives, also features *Quest*, a bookkeeping and accounting software package, and *SuperCalc*.

A choice of green phosphor terminals is also included with the system. The MDT20 is a beige terminal matching the color of the computer/drive enclosure. It is manufactured by Lear Siegler and roughly equivalent to their ADM20 model. The charcoal-colored MDT50 is manufactured by Liberty Electronics and similar to their Freedom 50 model. Both terminals retail for approximately \$545; however, if you already own an RS-232 terminal you can buy a Micro Decision without the terminal for that much less.

System Hardware

Honoring trends toward smaller, lighter equipment, the computer and drives are efficiently housed in a single enclosure measuring 16.7" wide, by 11.3" deep, by 5.3" high. The case is made of radio frequency inhibiting fabricated sheet metal, minimizing interference with television sets and the like. The plastic front panel is a matching shade of beige and, depending on the drive configuration, the unit weighs between 14 and 18 lbs.

The single board computer resting at the base of the chassis is at the heart of

rial port is used to interface to the terminal, leaving the second one free to attach to a modem or letter quality printer. The parallel port, similarly can be used to connect a parallel dot matrix or letter quality printer.

The disk drives which are two-thirds height on the MD2 and half-height on the MD3 further the overall efficiency of design. Unlike many floppy systems, the

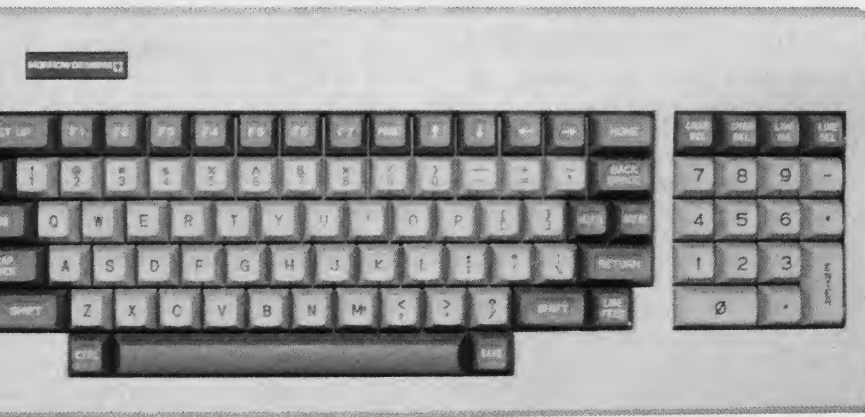
The MDT20 has a setup key which allows configuring many of the video attributes, simply by keyboard entry—a convenience lacking in the MDT50.

disk drive heads are in contact with the disk surface whenever the drive door lever is closed. This does not, however, seem to affect adversely wear on the disks.

From an external point of view, though, there are slight differences between the MD2 and the MD3, during disk operations. Aside from a reeling "whir" sound during read/write operations and a slight motor sound when the drives cycle on, the MD2 runs rather quietly. The MD3, on the other hand, is a bit noisier and more distracting during disk operations.

Both terminals provided with the Micro Design offer blink, reduce, and reverse video attributes on a standard size (12" diagonal) non-glare screen. Accommodating 80 characters per line, 24 lines per screen, with a 25th status line, the full 128 character ASCII set is displayed on a green phosphor, dot matrix field. Information can be transmitted in conversation or block mode, at rates up to 19,200 baud, although the Micro Decision itself is limited to a maximum baud rate of 9600. The terminals also feature an auxiliary RS-232 serial output port, supporting X-ON/X-OFF (Busy/Ready Handshake) protocol, which will operate at a different baud rate than the main port to the computer.

With all this in common, you might be wondering what is different about these terminals, aside from their color. To be brief about it, three things. First, the screen resolution is finer on the MDT50. Letters are crisper, thinner, and clearer with character serifs. Second, the keyboard is in some ways superior on the MDT50, since the control



The detachable keyboard on the MDT20 comes with 92 keys, including: a setup key, seven function keys, eight cursor control keys, four editing keys, and a fourteen-key numeric keypad.

Aside from user-friendly enhancements to the operating system, the computer comes with software packages covering the range of most initial software requirements. They include: *New Word*, a word processing program; *Correct-It*, a spelling checker and corrector; *LogiCalc*, an electronic spreadsheet program, and Morrow Designs' *Pilot*, *BaZic*, and *Micro-It's Basic 80*, three very different programming languages.

The MD3 version, which costs \$1999 and provides 768K of disk storage in two half-height 5¼" doublesided, double

this diminutive machine. It contains: a Z80A type central processing unit operating at 4 MHz, 64K of dynamic memory, 2K of EPROM, two RS-232C serial ports, one parallel port, and a floppy disk controller. A small switching power supply is located at the right of the chassis, in the rear. And although it is ventilated by convection-cooling the unit generates very little heat, even with extended use.

The I/O ports access the rear of the unit with plastic connectors mounted at right-angles to the circuit board. One se-



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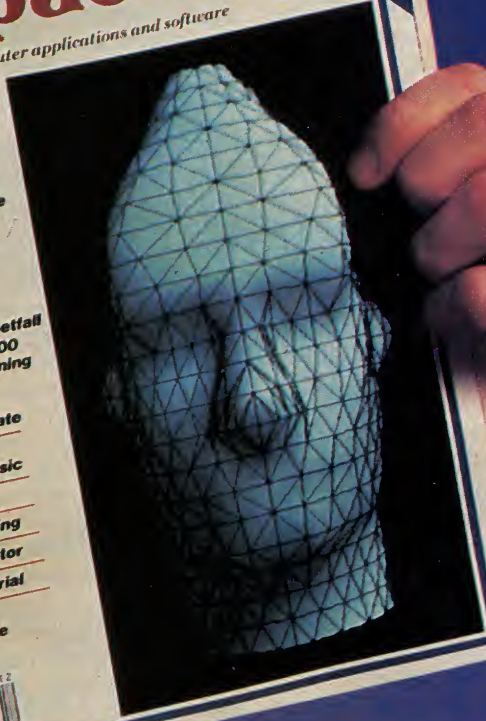
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VOL. 9, NO. 12

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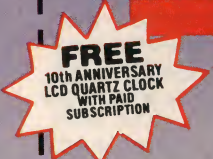
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IBM PCjr

Thomas V. Hoffmann

There is an old saying that the more things change, the more they remain the same. In 1981 when Will Fastie first introduced the IBM PCjr...

HARDWARE PROFILE

Product: PCjr

Ports: ROM cartridge sockets, bus extender, two joysticks, modem connection, audio output, composite video, direct drive monitor.

Dimensions: 14" x 11.5" x 3.5"

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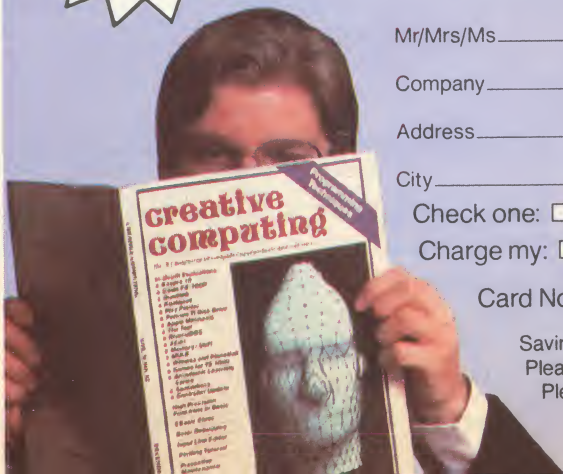
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IBM PCjr

Thomas V. Hoffmann

There is an old saying that the more things change, the more they remain the same. In 1981 when Will Fastie first looked at the IBM PC for *Creative Computing*, he described his first encounter of the close kind this way:

"I entered the contemporary but unremarkable building . . . Jeannette Maher of the Public Relations Department escorted me . . . through a tastefully decorated lobby and through smoked glass doors set in a wall of smoked glass. Inside . . . and there they were. Three IBM Personal Computers sat on three modular display stations." Then he began to drool.

Two years later, my first trip to Boca Raton was like visiting Déjà Vu City. Jeannette is no longer the sole PR person, but the tasteful lobby, smoked glass (now sporting a splashy neon *object de signage*), modular display stations, and three PCs were all there, just as Will described. Surprise! No PCjrs, not even a peanut shell on the floor.

Blind Man and Dancing Elephants

The good old days, when reviewers were ushered into the sedate presence of the original PC, have given way to more participatory modern times. The juniors were upstairs in someone's office.

We carted the stuff downstairs, cast aside the old PCs, and began setting up the juniors. The operation was totally trivial: open the box, attach the power

HARDWARE PROFILE

Product: PCjr
Type: Personal computer
CPU: Intel 8088
RAM: 64K, expandable to 512K
ROM: 64K
Keyboard: 62-key wireless keyboard, wire is optional
Display: Can run on IBM color display, none is included.
Graphics: 320 x 200 pixels, 640 x 200 pixels, 160 x 200 pixels
Printer: Can attach serial or parallel printer; none is included.

Ports: ROM cartridge sockets, bus extender, two joysticks, modem connection, audio output, composite video, direct drive monitor.

Dimensions: 14" x 11.5" x 3.5"

Documentation: Guide to operations, Basic manual, manual for each software package.

Price: \$599 with 64K and no disk drive \$999 with 128K and disk drive.

Summary: Extremely compatible with the IBM PC, easy to set up, suitable for home, office, and classroom.

Manufacturer:
 IBM Corp./Entry Systems Division
 P.O. Box 1328
 Boca Raton, FL 33432
 (305) 998-2000

cord to the system unit, attach a monitor to the appropriate connector, put batteries in the keyboard, and turn on the system—less than five minutes from box to operation, and only one third more calories than attaching a video game to a TV set. The PCjr might also be called IBM Lite—it weighs less than nine pounds with disk drive, and you can hold it in one hand and wave it around. (Yes, I did, and no, I don't know why. It seemed reasonable at the time.)

So just what *is* this PCjr? Is it a cheap PC or an expensive game machine? Who is it for? Where will it be used: home, office, classroom? How expandable is it?

How compatible with its older siblings? Is it worth the price? The answers depend, of course, on one's point of view.

It is definitely a PC, extremely compatible with its IBM predecessors, and significantly less expensive (about half the cost of a similarly configured original PC). The enhanced graphics and sound features make it a better machine for games and animation than the bigger PCs, but there are better and less expensive game machines. The real strength of the PCjr is that it is an IBM PC in every respect: same processor (the Intel 8088), same operating system (PC DOS), identical disk formats, and

compatible displays. The basic unit includes several features that are extra cost options on the big PCs: the video display adapter, serial port, and joystick adapter are all built in.

What, no bad news? Only a little: the PCjr is somewhat slower than previous IBM PCs, it can't support the 8087 arithmetic processor, and the current limitations on memory and disk may prevent the use of some large programs and data files. The speed difference is attributable to the design of the video display and RAM memory system, and is permanent. The other limitations, except for the absence of the 8087, are almost certainly temporary. The architecture of the PCjr will support considerable expansion; IBM and other manufacturers, such as Tecmar, Legacy Technologies, and Impulse Computer Products already offer a wide variety of options.

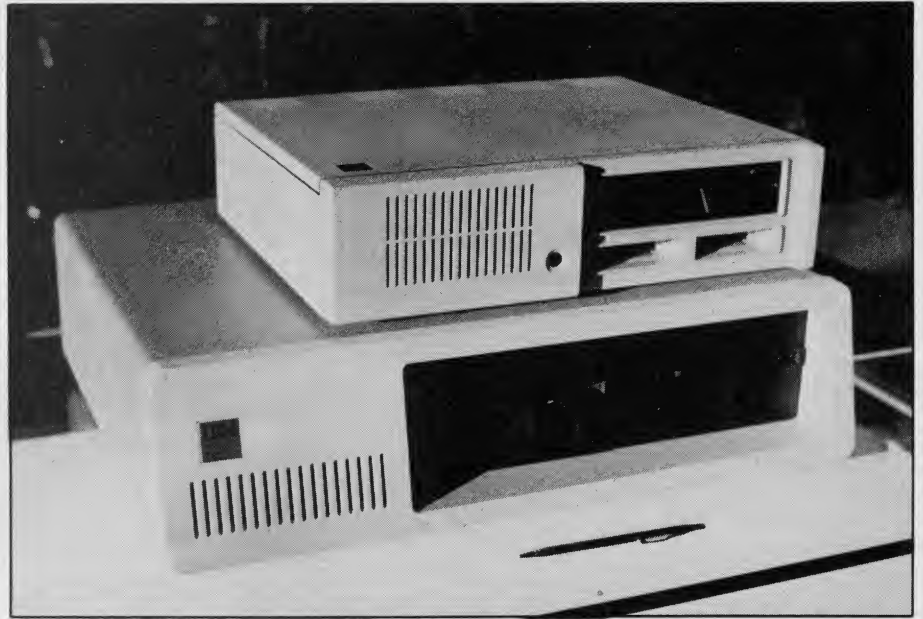
First Impressions

The PCjr is both more and less than the standard PC. Like the original IBM PC (now called PC1) it consists of two major components, a system unit and a keyboard, to which a display must be added to make a complete computer. The most striking difference between the junior and its predecessors is purely physical: it is *much* smaller.

At 14" wide by 11.5" deep by 3.5" high the system unit occupies only 43 percent of the volume of the PC1. The reduction in weight is even greater due to the plastic case (the others have metal cases) and external power transformer (sort of a giant AC adapter).

The 62-key wireless keyboard is perhaps the most innovative feature of the PCjr. It is powered by four AA batteries and communicates with the system unit over an infrared serial link with a range of up to 20 feet. An optional (i.e., extra cost) cable is available to connect the keyboard directly to the system unit. When connected by the cable, the keyboard is powered directly from the system unit, and the infrared system is disabled. This conserves batteries and eliminates interference among multiple systems in the same vicinity, as might occur in a classroom, for example. The cable may also be necessary to avoid interference with other infrared devices such as TV remote controls, in the home.

Another innovation, for IBM at least, is the provision for ROM program cartridges. Each cartridge contains 32K of ROM, but is quite a bit smaller than traditional video game cartridges. While there will be few programs available in this format initially, cartridges offer several significant advantages. They are much more rugged and reliable than



The PCjr system unit atop a standard PC system unit. The round opening is the infrared receiver for the cordless keyboard. The two ROM cartridge slots are directly under the half-height disk drive.

disk and cassette tapes, and are safer and easier for children to use. There is no loading time; the programs are instantly available when the cartridge is plugged in. Furthermore, since the cartridge programs can execute directly from ROM they leave all the RAM available for data storage.

Finally, cartridges offer greater immunity to casual software piracy, so vendors may be more likely to charge

It is a good bet that IBM has plenty of room for price reductions, should competitive pressures require them.

reasonable prices per copy for programs. (It has been estimated that for many popular programs, illegal copies in use vastly outnumber the legitimate ones. This undoubtedly raises software prices as vendors try to compensate for "free" copies.)

System Unit

The system unit is a marvelous example of low cost construction that never looks cheap, just inexpensive. It consists of a plastic box with a snap-on top cover. Inside, the main printed circuit card is mounted flat against the bottom, resting on snap-on plastic studs. There are four dedicated connectors for the power regu-

lator, memory expansion, internal modem, and disk adapter cards, which mount vertically. The on/off switch and the connector for the power cord (from the external step-down transformer) are mounted directly on the back of the power regulator card, and are accessed through openings in the outer case. The modem card has a standard modular telephone jack and a matching hole in the rear panel. All other peripheral and expansion connectors are mounted directly on the main system card and align with openings in the outer case.

The only two screws (actually bolts) in the box hold the disk drive in place. Everything else snaps in and out with bare hands: inexpensive to assemble, easy to upgrade or repair. It is a good bet that IBM has plenty of room for price reductions, should competitive pressures require them.

The main system board is about 11" by 14" and contains the following major elements:

- An Intel 8088 processor running at 4.77 MHz. The processor is configured in "min mode," which means the 8087 arithmetic processor cannot be used. There is no direct memory access (DMA) controller. An Intel 8259A interrupt controller chip and 8255A programmable peripheral interface are also used.

- 64K of ROM comprising cassette Basic (32K), BIOS or Basic I/O System (8K), and built-in diagnostics

- 64K of RAM for user programs

- An Intel 8253 timer chip, used for keeping time of day, timing I/O operations, cassette I/O, and PC1-compatible sound generation



The new IBM PCjr keyboard features 62 full-stroke typewriter style keys in standard QWERTY layout. The built-in infrared serial link has a range of 20 feet.

- Keyboard interface circuitry for both infrared and direct wire links
- Video display circuitry based on the Motorola 6845 CRT controller chip and a custom video timing and control chip, with connectors for high resolution RGB monitor, composite video monitor, TV receiver (with RF modulator), and light pen
- Audio cassette interface, compatible with that in the PC1
- Three channel sound/music generation circuitry based on the same Texas Instruments SN76496N sound chip used in the ColecoVision video game, with a standard RCA phono jack for audio output. Sound is also available through the TV when the TV adapter cable is used.
- Joystick interface
- Standard RS-232 serial interface, for external modems, printers, plotters, etc.
- Connectors for two ROM program cartridges
- I/O expansion connector for the parallel printer adapter and future add-on devices

There are two models of PCjr available. The entry system lists for \$599 and includes the wireless keyboard and system unit with 64K RAM and all the interfaces listed above. The enhanced system is \$999 and comes with an additional 64K of user RAM for a total of 128K, a disk adapter, and one half-height 5 $\frac{1}{4}$ " double sided, double density disk drive with a capacity of 360K, all mounted inside the system unit.

The connectors for peripheral devices, such as serial printer, high-resolution display, and joysticks, are not the usual 9- and 25-pin D connectors usually found in small computers. The PCjr uses rectangular arrays of pins, similar to those used for flat cable connectors on PC cards, soldered directly to the main systems board. Special adapter cables are available for each device, where appropriate, to convert to industry standard D connectors. This lowers the cost

of the system unit, but adds an occasional \$20 or \$30 for adapter cables for displays (essential) and serial devices.

The disk drive, manufactured by Qume, is mounted horizontally in the upper right corner of the system unit, right above the two cartridge slots. It is half the height of a standard 5 $\frac{1}{4}$ " mini-floppy drive, and very slightly slower due to longer head settling times. The difference is hardly noticeable.

In a standard minifloppy drive you insert the disk and flip down a hinged door to engage the drive spindle and read/write head. On the PCjr you rotate a lever counter-clockwise to engage the mechanism; the same lever blocks the entry slot so the disk can't be removed until the lever is flipped back. I found the lever mechanism easy to use, once I overcame my instinctive groping for the flip-down door. If you have never used a standard floppy, there may be no instincts to overcome.

The 360K capacity of the floppies is identical to the PC1 and PC/XT, and quite a bit greater than most other "home" computers in this price range, where single sided, single density drives of about 100K are the norm.

Keyboard

The original PCjr keyboard generated a great deal of controversy. IBM called it "a cordless, portable, hand-held device (utilizing) full travel, carbon contact/rubber dome technology for long wear and reliability." Critics called it a cheap "chiclet" keyboard unworthy of a "real" computer, with the infrared link a superfluous gimmick. In the end, IBM admitted that the keyboard needed to be replaced.

The new keyboard uses the infrared link and has 62 fullstroke typewriter style keys. The key legends are printed directly on the keys, not in between the keys as on the old keyboard. Better yet, IBM uses the real standard QWERTY

layout on the PCjr keyboard. It has no backslash key in between the Z and the left SHIFT key; the RETURN key is correctly placed above the right SHIFT key; and labels are on the SHIFT, RETURN, BACKSPACE, and TAB keys.

The keyboard is slant adjustable and includes a ridge along the top to hold pencils or prop manuals between the keyboard and system unit. The keyboard dimensions are 13.45" x 6.61" x 1.12", and it weighs a little less than two pounds.

The standard PC keyboard has 83 keys, the PCjr only 62. What is missing? The ten function keys on the left of the standard keyboard are gone. Instead, a new FUNCTION SHIFT key has been added to the upper right side. To generate a function code, depress the FUNCTION SHIFT key (surrounded by a green box), then the corresponding numeric key in the top row (1 through 0). For SHIFT, CONTROL, and ALTERNATE shift combinations, the same procedure applies; first hold down the FUNCTION SHIFT, then press the desired combination. This sounds much worse than it really is. The technique is entirely consistent, logical, and obvious.

The separate numeric keypad is also gone, replaced with four cursor control keys. The HOME, PAGE UP, PAGE DOWN, and END cursor controls are triggered with the FUNCTION SHIFT key. Other keys, such as SCROLL LOCK, BREAK, and PRINT SCREEN, are also triggered with a FUNCTION and letter key combination.

Perhaps the best news, at least to owners of the old PCjr keyboard, is that you can obtain the new keyboard free-of-charge. Just bring proof of purchase back to the dealer from whom you bought the PCjr, fill out the forms, and let the dealer mail the forms to IBM. IBM then sends the new keyboard to your dealer.

Audio

In addition to the simple tone generator from the older PCs, the PCjr has a sound generator chip with three independent channels, or voices, each with independent attenuation (volume control), plus a noise generator. Music in three-part harmony, explosions, and other neat effects are possible with the right programming. The extended Basic cartridge includes statements to support these enhanced sound capabilities.

The audio output is available at the rear of the system unit. With an external amplifier and speaker (or home stereo or tape deck) connected to the audio output jack, you can play to the whole neighborhood, record for posterity, or do other creative audiophile kinds of things. Even more interesting is the audio *input* line in the external I/O expansion

sion bus, which can be mixed with the internally generated sound. Can add-on speech synthesizers be far behind? Daisy, Daisy . . .

Video Displays

The video display system in the PCjr is a direct descendent of the original PC color graphics adapter, with three significant improvements. First, most of the logic on the old card has been put in a single custom integrated circuit; what was previously a whole circuit board is now two big chips and a few little ones, and included in the basic price (instead of being a \$244 "mandatory option"). Second, the entire 128K of user RAM can be used for video storage; previously only 16K on the video card was available. This allows many more "pages" or images to be kept in memory and switched rapidly to the display—good for quick help screens, animation, and the like. Third, the color capability has been improved significantly.

The old PCs could display 320 by 200 dots in four colors (medium resolution), or 640 by 200 dots in two colors (high resolution). Unfortunately, in high resolution one of the colors was always black, and in medium resolution the color choice was limited, confusing, and a little ugly. The PCjr makes two important enhancements: independent choice of graphic resolution (160, 320, or 640 dots wide) and color resolution (16, 4, or 2 colors), and a completely general color palette. The high resolution 16-color mode would consume all 128K of memory, and thus could be reasonably used only by a cartridge program.

The color palette allows an arbitrary choice of any of the 16 possible colors to be assigned in any mode. The result is a much more flexible all-points-addressable color graphics system, much better suited to pictorial displays for games and educational programs. In other words, it looks much better and is more fun.

There is support in Basic for the enhanced color modes as well as the standard (i.e., old PC) graphics and 40- and 80-column alphanumeric display modes. The PCjr has the same 256-character display set as the previous IBM PCs. The designers have gone to considerable trouble to make the new hardware compatible with most of the software tricks that existing PC programs have used in display generation, and they have done an excellent job.

The PCjr does not support the high-resolution IBM monochrome display. There are provisions for connecting high-resolution RGB color monitors (via a \$20 adapter cable), composite video monitors (via a standard RCA phono plug), and television sets (via a \$30 cable

including an RF modulator). The TV connection also sends the audio output to the set, where it can be adjusted with the volume control knob.

Options

Another bone of contention between IBM and the critics concerned the RAM available. IBM deliberately limited the original memory of the PCjr to 128K, which is not really enough to run many of the popular software packages. Third party manufacturers like Tecmar, Legacy Technologies, and Impulse Computer Products stepped in to make RAM expansion units. IBM, realizing that the 64K upgrade to 128K was not enough, introduced the 128K Memory Expansion Attachment.

The Memory Expansion Attachment adds 128K RAM, boosting the total memory to 256K, which is enough to run just about every software package on the market. Better yet, two more Mem-

IBM people taunted us about the mysterious connector marked L on the rear panel. They said it stands for "later."

ory Expansion Attachments can hook up to the PCjr, albeit indirectly via a Power Expansion Attachment, bringing the machine up to a respectable 512K RAM.

Other hardware options include an Internal Modem, Parallel Printer Attachment, and Speech Attachment.

The internal modem, made by Novation, is a full-featured smart modem for 110 and 300 baud communications. The modem card contains its own serial interface device, so the standard serial port is still available for attaching a printer or other device. The modem supports automatic dialing (pulse or tone) and answering, with error detection and diagnostics supplied in the system ROM.

The parallel printer attachment attaches to the 60-pin I/O channel expansion connector on the right side of the system unit. The attachment is required to support standard parallel printers such as the IBM Graphics Printer, Epson, Oki, and others. The I/O channel is passed through so that future options may be attached, always moving rightward. The current power supply will support up to five attachments on the I/O channel, plus the internal disk and modem.

The PCjr ROMs have provisions for handling "non-Keyboard scan codes" arriving through the infrared link. Speculation about wireless joysticks received an immediate "we can't comment on that" response from IBM people in the vicinity, who then taunted us about the mysterious connector marked L on the rear panel. They said it stands for "later." Stay tuned.

The speech attachment is a speech synthesizer using Linear Predictive Coding and Continuously Variable Slope Delta modulation to support speech and sound. It contains 196 words in ROM, supports speech encoding in compressed mode, and includes a microphone jack. Speech can be recorded to disk or cassette.

Software

The built-in 64K ROM contains diagnostics, hardware I/O routines (BIOS) used by Basic, and the disk operating system, and the cassette Basic interpreter. PCjr cassette Basic is essentially the same as the standard PC cassette Basic: the essential features of the language plus program and data files on cassette tapes.

Advanced Basic features are provided in the PCjr Cartridge Basic (\$75), which plugs into either of the two ROM cartridge slots in the front of the system unit. The 32K ROM cartridge augments the standard cassette Basic with advanced graphics, sound and music, communications support (including a terminal emulator), and disk I/O (with DOS 2.1). The result is a superset of the standard PC advanced Basic, which requires disk and DOS and is partially RAM resident, all in ROM. DOS is required only if you want to use disk files.

DOS version 2.1 is the recommended disk operating system for the PCjr. (Earlier versions seemed to work as well, but IBM will support only version 2.1 and beyond.) DOS 2.1 has the same functions and storage requirements as DOS 2.0, and runs on the PC1 and PC/XT as well as the PCjr. The major difference is that Basic and BasicA require Cartridge Basic on the PCjr as a prerequisite. If the cartridge isn't plugged in, disk Basic won't run. Most of the utility programs supplied with DOS are identical in versions 2.0 and 2.1; the few that are different seem to have had some minor bug repairs made, but there are no significant enhancements.

There are now quite a few game cartridges available for the PCjr. Many, if not most, of the disk software packages for the PCjr are identical to those for the PC1 and PCXT. In some cases, only the latest versions will work on all three machines. Dealers will have a complete list of IBM-produced or distributed software

compatible with the PCjr.

Compatibility

Whether any piece of software is compatible with the PCjr is hard to predict with certainty, but certain considerations should be taken into account. The most obvious is the single disk drive. The single drive will function as two logical drives, A and B, with the system prompting you to change disks when necessary.

For some applications, this is acceptable. For others, it is ridiculous. For example, if a program copies data from one disk to another one record at a time instead of in big blocks, thousands of insertion/removal/insertion cycles might be required. Logically, it works; physically, you should live so long. Try before you buy.

Programs, such as APL, that require the 8087 will never work in the PCjr. Programs that make assumptions about the length of time a sequence of instructions should take may not work, since the PCjr is slower in accessing the user RAM. Programs that directly access some devices (especially the disk and display systems) also may not work. Some software copy protection schemes might fall into these traps.

In general, programs that follow the rules of BIOS or DOS for device access, don't require more memory than is available, and don't need hardware that isn't there (like the monochrome display), will run without change on the PCjr.

Conclusions

I like this machine very much. For the home, its graphics and sound features provide a good base for high quality, enjoyable games and educational software. Its compatibility with the PC1 and PCXT make it ideal for occasional work-at-home use, sharing programs and data with the machine at the office.

The PCjr makes sense for the office, too, as a PC-compatible spreadsheet workstation, programmable telecommunications terminal, or wherever the higher cost standard PC isn't quite justifiable. It is a great machine for schools as well—at all levels. From Logo for the little ones, through introductory computer architecture for college classes, the PCjr is a credible vehicle for serious education with or about computers.

For myself, I would love to have one right now. Instead of sitting upstairs in my cold den, typing fast to keep my fingers from stiffening from the cold air flowing through the gaps around my storm windows, I could be downstairs, comfortably nestled on the couch, with a roaring fire in the fireplace, warmly, leisurely, cordlessly processing these final words. But then I might never finish. **END**

CIRCLE 498 ON READER SERVICE CARD

Prices and Configurations

Here is a quick summary of the prices for representative PCjr hardware and software components, and some typical configurations.

Description	Price
PCjr System Unit (64K, keyboard)	\$599
64K Memory/Display Option	140
PCjr 128K Memory Expansion Attachment	325
PCjr Disk Option	480
PCjr Power Expansion Attachment	150
PCjr System Unit (128K, keyboard, disk)	\$999
IBM Color Display	680
PCjr Internal Modem (300 baud)	199
PCjr Parallel Printer Attachment	99
Connector for TV (with RF modulator)	30
Connector for RGB Display	20
Connector for Cassette	30
Connector for Serial Devices	30
Cable for Parallel Printer	45
Keyboard Cable	20
IBM Graphics Printer	\$449
IBM PC Compact Printer (thermal)	175
IBM PCjr Attachable Joystick	40
PCjr Speech Attachment	300
PCjr Carrying Case	60
Cartridge Basic	75
DOS 2.1	65
Multiplan 1.10	250
VisiCalc 1.2	200
HomeWord	75
EasyWriter	175
Entry Level Home Configuration	
PCjr System Unit (64K, keyboard)	\$599
Connector for TV (with RF modulator)	30
Connector for Cassette	30
Cartridge Basic	75
	\$734
Home Budget/WP System	
PCjr System Unit (128K, keyboard, disk)	\$999
Connector for TV (with RF modulator)	30
IBM PC Compact Printer (thermal)	175
Cartridge Basic	75
DOS 2.1	65
Visicalc 1.2	200
Homeword	75
	\$1,619
Communicating Office System	
PCjr System Unit (256K, keyboard, disk)	\$1324
IBM Color Display	680
Connector for RGB Display	20
PCjr Internal Modem (300 baud)	199
PCjr Parallel Printer Attachment	99
IBM Graphics Printer	449
Cartridge Basic	75
DOS 2.1	65
Multiplan 1.10	250
	\$3161

Memotech MTX-512



In the hard-edged business of micro-computer journalism, you have to be prepared to make sacrifices, and to make them on a moment's notice. That is what being a professional is all about.

That is why I unhesitatingly sprang to the fore the moment the assignment came my way: a reconnaissance trip to London to look at the new MTX-512 from Memotech.

A tough job, but then, somebody had to do it.

In these very pages, we have repeatedly told you of the invasion of the micro-redcoats—told you that the British were coming, in no uncertain terms. We recently told you about the BBC Acorn and the ACT Apricot. We also previewed the Sinclair QL-10.

Now Memotech, which began as a Sinclair hardware peripheral manufacturer, has entered the fray with its own micro—the MTX-512.

And it is no mere clone or warmed-over CP/M machine. It is a sleek, sexy contender with some very unique features. If you have scanned the field of under \$1000 machines and come up dissatisfied, the MTX-512 is assuredly worth a look.

John J. Anderson

Aston-Martin of Micros?

I usually leave the styling superlatives to sister publications, such as *Car and Driver* and *Stereo Review*, but in this case shall make a happy exception. The MTX-512 is a real looker. It is a computer capable of looking as "at home" in your living room as your stereo does. And if it were an automobile, it would invite comparison to an Aston. Both are machines to stop you dead in your tracks, asking with a silly smile, "hey, what's that?"

The MTX-512 resides within a jet black, brushed aluminum case. It is long, and low: 19 inches from stem to stern, yet only 8 inches across and a mere 2.2 inches high.

Touch the anodized case, and you can feel quality. Remember metal? That's the stuff they used to use a lot more of, before plastic came along. It gives the MTX-512 a bit of weight, which keeps it sure-footed on its rubber feet. What a pleasurable contrast to high-impact styrene.

One good-looking machine, to say the

least. Feels good, too, like slamming the door on an XJ6.

Built for Performance

Though I will admit that things seem to be moving in the direction I'm about to describe, computers have not as yet assumed the mechanized role of sex symbol—as the automobile has somehow managed to do. Most people still care more about what a computer can do than how it looks. (Still, I imagine most people would be satisfied with a micro, as they would with a mate, that scored highly on both accounts.) You most certainly would not buy a car based *purely* on its looks. Nor would you buy a computer that way, right?

Pretty Is as Pretty Does

I am happy to report that the MTX-512 begs comparison with Astons and Jaguars for its *performance* as well as its looks. For beneath its beautiful skin, there resides a powerful, unique, and versatile design, in some respects grounded firmly in proven tradition, and in other respects, truly innovative.

Consider the case of the casing. That
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metal casing serves as more than mere status symbol, in contrast to the impact styrene covers of the Commodore 64 and Atari. It performs three important functions simultaneously. It obviously protects the innards of the machine. It acts also as a heat sink, draining off damaging component temperature extremes, and it serves as a Faraday cage, completely sealing off RFI (radio frequency interference) that can cause static for and with nearby radio listeners, and even impair the video quality of the computer's own output. The MTX-512 is one machine that sailed through FCC approval procedures with flying colors—the first time around.

Kitten on the Keys

Form follows function, example 2: let your fingers do the walking down the 79-key, full-stroke, sculptured keyboard. Tap them down to feel how really good keyboard touch should feel. Check the layout. Not true Selectric-style, unfortunately, (apostrophe not on the right but on the shifted 7, a la Apple II and C-64), but very nearly so. The numeric keypad is standard, with directional arrow keys overlaid upon them. Eight programmable function keys are on the far right of the top panel. Used in conjunction with the Shift key, another set of eight functions becomes available. The F and J keys are recessed for easy fingertip location and homing. On either side of the spacebar are two unmarked reset keys. Both must be depressed simultaneously to trigger a cold start. All alphanumeric keys offer full autorepeat.

A keyboard diagram is reproduced here as Figure 1.

Under the Hood

Okay, stop salivating on the upholstery. Get ready to fasten your seatbelt and we'll take it for a test drive. But first, let's take a quick look under the hood.

The processor for the MTX-512 is the tried and true Z80. Sure, you could argue that the Z80 is past its prime, but you surely can't argue very long about its shortcomings in comparison with other 8-bit CPUs. Memotech chose to go with a chip that has a productive and respected past—as well as future. The Z80 can do it all; it can perform quickly and address a

HARDWARE PROFILE



Product: Memotech MTX-512
Type: Desktop microcomputer
CPU: 8-bit Z80 at 4MHz
RAM: 64K standard, expandable to 512K.
Keyboard: 79 keys, full-stroke
Text Resolution: 40 x 24
Graphics Resolution: 256 x 192
Color/Sound: 16 colors, 3 tone channels, 1 pink noise channel
Ports: Cassette, joystick (2) parallel printer, ROM cartridge. Serial ports optional.
Performance: Very good
Documentation: Fair
Price: \$595
Summary: An excellent learning machine, built with an emphasis on quality. With a low-cost disk drive, could be an extremely versatile system.
Manufacturer: Memotech Corporation
 99 Cabot St.
 Needham, MA 02194
 (617) 449-6614

good-sized chunk of RAM directly. It also raises the possibility (spectre?) of CP/M compatibility. And the Z80A inside the 512 operates at 4MHz. Radar detector is strictly optional.

Included in the \$595 base sticker price is 64K RAM, expandable to 512K (hence

the model moniker MTX-512). Add to this another 16K RAM standard dedicated solely to screen memory. The video circuitry includes its own processor to handle video housekeeping.

Alive, Alive I/O

Also included as base-sticker standard are the following ports: variable rate cassette port (to 2400 baud), two digital joystick ports using industry standard (Atari) configuration, Centronics standard parallel printer port, ROM cartridge port, and uncommitted parallel port.

Available as an option is a communications board which carries two completely independent RS-232C interfaces (to 19,200 baud) and a disk drive bus. As mentioned above, RAM memory is optionally expandable to 512K. RAM can be added in increments of 32, 64, 128, or 256K.

ROM on Board

In addition to RAM for the main processor and screen display, the MTX-512 contains 24K of ROM with some really neat goodies packed inside. These include MTX Basic, "Noddy," a simple, Pilot-like text-handling language, an assembler/disassembler, and ground-breaking "Front Panel" program that allows all three languages to interact in concert. We shall examine this software in a bit more detail up ahead.

ROM expansion can take place internal to the MTX, or through the ROM cartridge slot, to a maximum of 72K. That would imply quite a smart machine indeed.

Does Windows, Too

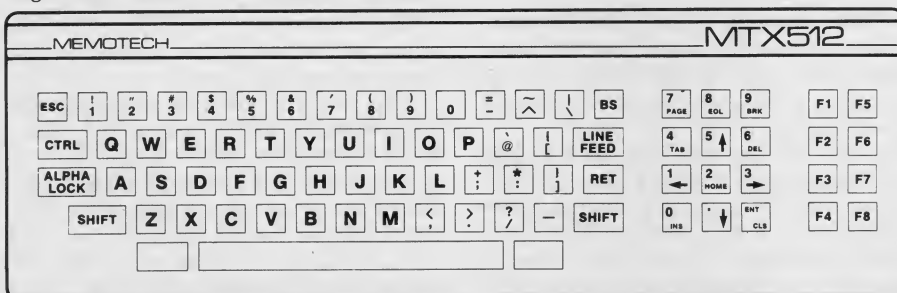
The screen specs of the MTX machine are as impressive as its physical look. Separate outputs are offered on the back panel for monitor and TV (with internal RF modulator). Graphics resolution is 256 x 192 pixels in 16 colors. Text resolution is a standard 40 x 24 characters in a unique and pleasing font.

In addition to conventionally bit-mapped modes, the MTX-512 offers 32 user-definable sprites—which are controllable through high-level Basic commands. This means that sprites and sprite movement can be defined straightforwardly from Basic without recourse to cryptic POKE commands.

The MTX also has a unique and powerful windowing feature: eight user-definable "virtual screens"—controlled through special Basic commands—are available. The result is Basic-programmable text or graphics windows with remarkable ease of control.

Hi-fidelity sound is pumped through the RCA phono plug output on the rear of the MTX unit. Four channels are available—three independent tone generators, and a "pink noise" channel for percussion and sound effects. Alternatively, sound is

Figure 1.



Command Words — MTX BASIC

ADJSPR	DIM	LPRINT	REM
ANGLE	DRAW	MSVPR	RESTORE
ARC	DSI	NEW	RETURN
ASSEM	EDIT	NEXT	ROM
ATTR	EDITOR	NODDY	RUN
AUTO	ELSE	NODE	SAVE
BAUD	FOR	ON	SBUF
CIRCLE	GENPAT	OUT	SOUND
CLEAR	GOSUB	PANEL	SPRITE
CLOCK	GOTO	PAPER	STEP
CLS	IF	PAUSE	STOP
CODE	INK	PHI	THEN
COLOUR	INPUT	PLOD	TO
CONT	LET	PLOT	VERIFY
CRVS	LINE	POKE	VIEW
CSR	LIST	PRINT	VS
CTLSPR	LLIST	RAND	
DATA	LOAD	READ	

Figure 2.

NODDY COMMANDS

BRANCH ENTER PAUSE
IF ADVANCE LIST
GOTO RETURN OFF
STACK DISPLAY

When working in NODDY you can:

- 1) create a page by giving it a title of your choice,
- 2) type DIR to see what pages already exist,
- 3) look at a page already in the Directory by typing its title.

NODDY also allows you to construct PROGRAM PAGES using the commands listed above, to manipulate and display text interactively.

Figure 3.

FRONT PANEL DISPLAY Commands

B followed by Y (i.e. BASIC, then Y/N) returns user to BASIC
C clears the List screen
D displays memory in hexadecimal
G (go) runs a block of code defined by the user
I cycles the display between ASCII characters or machine code values currently in memory
L lists memory contents from a given hex address
L. lists memory contents from current Program Counter address
M moves a block of memory to a given address
R alters contents of a given Register
S single steps through code from current Program Counter address
T as above but treats Calls as one instruction
X displays alternate Register set
= moves Register cursor
- moves memory display cursor backwards
<enter> moves memory display cursor forwards
↑ moves display up
↓ moves display down
<brk> stops a program and displays register contents

Figure 4.

also routed through RF for output on a standard television set.

Powering Up

Let's start her up and take her around the block.

There is no power switch on the MTX-512 itself; rather, we find an illuminated rocker switch on the matching external power supply used to turn the computer on and off. Flip it on, and we have ignition.

Upon power-up, we are in MTX Basic. This dialect is very much like Microsoft Basic, with a large number of added special graphics, sound, and window commands (see Figure 2).

Noddy is a text manipulation language that reminds me a bit of Logo, and even more of Pilot. Noddy is British slang for "simple," and that it is. Using Noddy, even a child can master sophisticated branching capabilities. The language provides a tre-

mendously easy-to-use method of programming the computer to display information or ask questions, then branch to a new screen based on the response to the old one. Available Noddy program commands appear here as Figure 3.

Here another unique facet of the MTX architecture becomes apparent. Basic and Noddy are completely interactive, allowing screens to be named, constructed, incorporated into a tree structure, and then called from Basic programs. On exit from Noddy to Basic, all Noddy screens and programs are left intact. In situations where branching text screens are needed, Noddy is the way to effect them—and Noddy can effect them seamlessly from within Basic programs.

Also onboard ROM chips and accessible from power-up is a powerful Z80 assembler/disassembler. Source and object code occupy the same space in memory, allowing very compact storage of large assembly language programs. As with Noddy, MTX Basic can also interact fully with this module as well. As a result, machine code programs may be included within a Basic program and assembled as the program is run—there is no need to define fixed areas for the machine code to reside—and no USR addresses to calculate or miscalculate.

The Front Panel Display acts as a dramatic machine language tutorial and has helped as far gone an assemblerphobe as me overcome fear of the stack. The name comes from a time when computer keyboards had yet to be perfected, when programming took place across banks of lights and toggle switches on the front panels of the behemoth ancestors of today's micros.

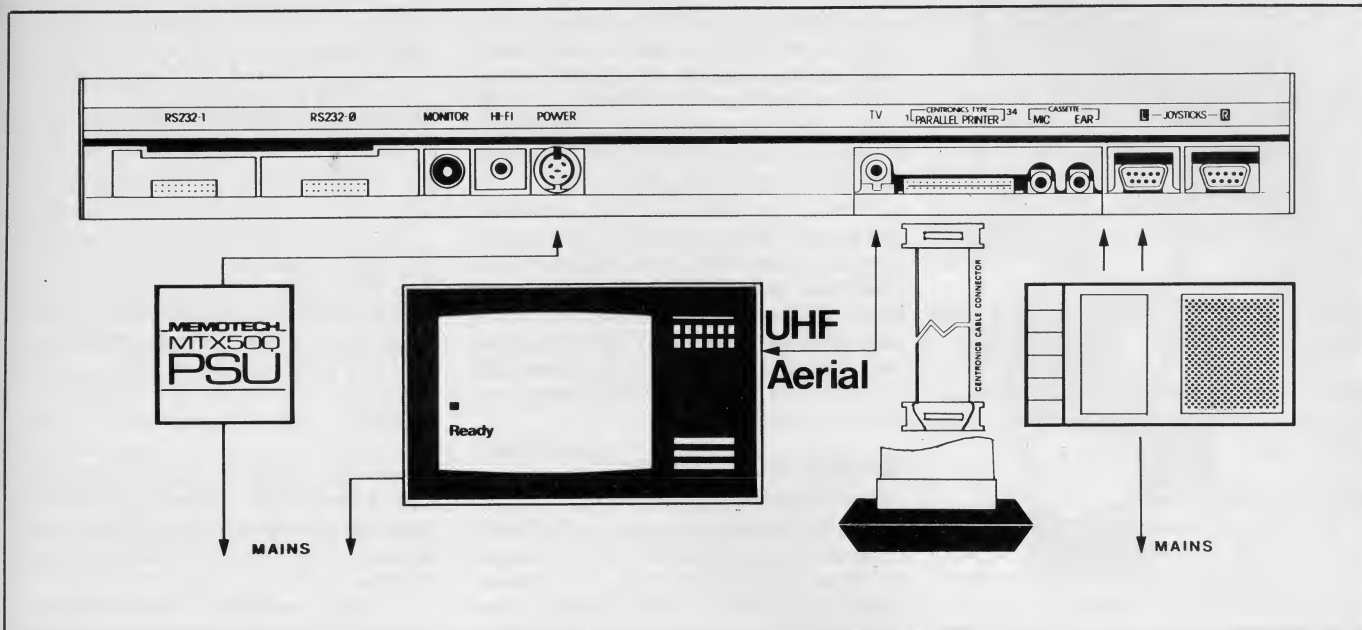
The MTX front panel is an interactive program which allows manipulation of the contents of memory and Z80 registers. It is useful for tracing the internal interactions of the computer while a simple program runs. In fact I could recommend no better way to master beginning Z80 assembly instructions.

The program is also obviously a big help in debugging machine code programs. It displays the contents of all registers and command pointers during program execution. Figure 4 presents the commands available from the front panel.

"Tired" Analogy Strikes Again

Earlier I compared the MTX to British luxury/performance cars to underscore its appointments and quality construction. It turns out the comparison is especially fitting when describing the screen editor of the machine as well.

Americans have gotten as used to full-screen editing as they have to driving on the righthand side of the road. Want to make a change? Use the cursor keys to move the cursor over the offending code,



The rear of the MTX-512, with peripheral hook-up diagram.

make the change, then press Return. As far as we Yanks are concerned, that is the way to make an alteration.

Well when you first sit in front of an MTX-512, you may get the feeling that the steering wheel is on the wrong side of the computer. The screen editor is powerful, but it just doesn't work the way you expect it to. First of all, editing takes place within a four-line virtual screen at the bottom of the display. To change a line, retype its number to bring it into the editing window. Then you can make the change.

At first, you may find the effort of mastering the MTX editor a bit of a chore (and at times a bit scary—like the first time you drive on the lefthand side of the road). With a little practice, however, you will overcome the urge to move the cursor straight up out of the editing window to make changes at the top of the screen.

The MTX editor does effect immediate syntax checking, and positions the cursor at the offending character in the rejected line for easy alteration.

All Basic and Noddy language commands can be abbreviated during entry and editing, and will appear in non-tokenized form when listed. Basic lines can be entered in upper- or lowercase with commands listing in uppercase. Extra spaces will automatically be trimmed off upon listing as well.

Ring Up the MTX-512

The MTX is undeniably engineered to compete head-to-head with the Acorn in the field of education. The Acorn is a big seller in Britain and is sanctioned by the BBC, which is influential not only in the U.K. but in many places worldwide. The Acorn hence has quite a head start on the

512 on this account. (As an aside, we are very disappointed to report that no Acorn has of this writing appeared at the lab for exhaustive evaluation. U.S. entry of the machine has been delayed for a half-year now).

The MTX competes favorably with the Acorn, however, as a heavy-duty education machine, and if Memotech can effect distribution in this country before its rival, it may get a chance to cut ahead in the development of a U.S. beachhead.

The MTX competes favorably with the Acorn as a heavy-duty education machine.

One facet of the MTX-512 that is sure to interest educators is the "Oxford Ring" node software, which may be used inexpensively to link up to 255 MTX units together. The software can pass all manner of programs, mail, and data among all members of the ring. A hard disk unit can complement the ring and be accessed by slave as well as master units connected to it.

In a classroom situation, this kind of network can improve the quantity and quality of learning by allowing one instructor to teach one concept while allowing all students immediate interaction with the concept being taught. This contrasts markedly with a group of computers all

running free and unattended by an instructor.

I saw the Oxford Ring in action in no less fitting a locale than Oxford itself and can report with confidence that it really works. This is more than I can say for the BBC Acorn, which claims networking capability but has so far not delivered on the promise, at least in front of American witnesses.

Of even greater interest to educators will be the cost of the node system—\$20 per computer. That is quite a bit less than any other working node system.

Breakneck Benchmark

I myself am not a big believer in benchmarks, and so feel compelled whenever I invoke them to preface things with some sort of disclaimer. Remember, folks, no one statistical method reliably tells you which computer is better than another. You must decide that for yourself.

I can report without qualification, however, that the David H. Ahl Quickie Benchmark is as fair and simple a micro benchmark test as I have seen. We have used the program to compile benchmarks on everything from the Sinclair ZX81 to the Cray 1. Despite a distrust of benchmarks, I have gotten into the habit of running this one on every micro I evaluate for *Creative Computing*.

The MTX-512 fared quite well indeed on its go-round with the test, coming in at 46 seconds, with an accuracy of 0.000252962112 and a sum random of 6.9. (More information on benchmarks can be found in regular issues of *Creative Computing*.) This was well ahead of the Epson QX-10, TRS-80 Model 4, Atari 400 and 800, Commodore 64, and TI 99/4A, though it is slower and slightly less ac-

Color	Monochrome
White	Flash
Red	Underline
Green	Background
Blue	Bright Up
Yellow	Reverse
Magenta	
Cyan	

Figure 5.

curate than the BBC Acorn. In all, a very respectable showing.

(Remember, as the benchmark runs from Basic, we are measuring the speed of Basic as well as processor speed in conducting these tests.)

The Toaster Oven

Two external mass storage devices will soon be made available for the MTX-512. They both reside in handsome, coordinated cases which I quickly dubbed "the toaster oven" not because they get hot, but because of their unique look. (Though the units do get lukewarm, you'll be wasting time trying to do English muffins in them.) The chassis is exactly as long as the keyboard unit, and again, is made of extruded brushed black aluminum (or aluminium, if you're a Tory). A monitor can very conveniently perch atop a toaster oven, at a comfortable and readable height.

The disk-based systems come in two flavors: dual 5 1/4" floppy, and floppy/Winchester hard disk. "Silicon disk" boards are also available to simulate instantaneous access disk drives. A little more about that appears up ahead.

In addition to the storage devices themselves, the toaster oven sports an internal card cage which accommodates a computer expansion board (standard), a color 80-column board with RGB output (standard), up to four "silicon disk" memory boards (optional), and battery back-up (optional). Also available from this chassis is an additional parallel port for further bus expansion.

The CP/M Connection

With both the FDX floppy version toaster oven and the HDX Winchester version toaster oven, the CP/M operating system is used. A CP/M 2.2 disk comes standard with every unit. More FDX units can be hooked together to create a multidrive CP/M system.

With the advent of CP/M on the MTX system, reams of tried, tested, and terrific software become available. And running CP/M on the MTX is not like running it on any other system. The screen display is truly superlative.

Toasted RGB with Buffer

Try 80 columns by 24 lines in seven colors on for size, with two 96 element character sets, each sporting true, easy-

to-read descenders. RGB graphics mode offers 160 x 96 pixel resolution and teletext compatibility. Want to talk speed? Screen update takes place at an average of 25,000 baud. That means an entire text screen can change in about the time it takes an IBM PC to scroll a single line.

Then there is the fact that the MTX-512 automatically turns monochrome software into color software (see Figure 5). It translates special character modes into color changes, which are much easier to recognize and work with. Once you have had a chance to run CP/M on a Memotech, it will be hard to return to any conventional CP/M system.

Slipping in Silicon Disks

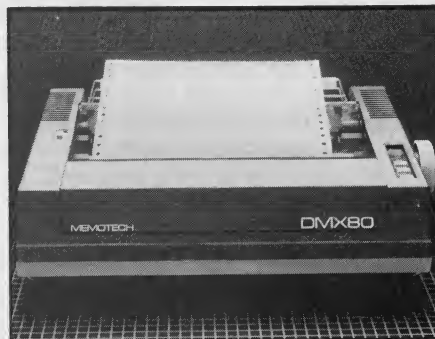
Each Memotech silicon disk is a quarter or one megabyte fast-access RAM board, capable of emulating CP/M drives 0 to 13. Four such boards may be mounted within the HDX or FDX toaster oven chassis, providing from one to four megabytes per card frame. However, the silicon disk controllers can supervise four logical drives of up to 8 megabytes each—giving a maximum silicon storage of 32Mb.

Silicon storage is superior to floppy and hard disk storage. It is up to five times faster than a Winchester disk, and 50 times faster than a floppy. It reduces disk wear and swaps, and enhances disk reliability. And the cost of silicon storage continues to drop.

Picture it: a 512K color CP/M machine, with 160 megabytes of floppy, hard disk, and silicon storage! Probably enough to handle the NORAD system—and in seven colors yet.

Print About the Printer

We were impressed from stem to stern by the MTX-512 and its companion units, the FDX and HDX. Then we got a look at the companion printer, the DMX-80. This unit, OEM Panasonic, is perfectly matched to its master. It is turned out in jet black Memotech livery, with a brushed texture, and has the Memotech red pin-stripe across it as does the MTX-512. The machines make a handsome pair. The DMX-80 is an Epson work-alike and



DMX-80, high quality at low-cost, in MTX-512 livery.

```
BCDEFGHIJKLMNOPQRSTUVWXYZ
##%&'()*+,-./0123456789
stuvwxyz{|}~!"#$%&'()*
defghijklmnopqrstuvwxyz
EFGHIJKLMNOPQRSTUVWXYZC
!"#$%&'()*+,-./0123456
pqrstuvwxyz{|}~!"#$%&'
abcdefghijklmnopqrstuvwxyz
RSTUVWXYZ[\]^_`abcdefg
CDEFGHIJKLMNOPQRSTUVWXYZ
456789:;<=>?@ABCDEFGHIJ
%&'()*+,-./0123456789:;
```

Figure 6.

produces a typeface nearly identical to that of the MX-80 (Figure 6). While it is no speed demon, it is tolerably fast, quiet, and easy to use. Parallel interface cabling is trivial.

And that's not all. The real news about the DMX-80 is that it costs a mere \$400, and comes with a one-year guarantee on *everything*. That is an unprecedented value. When you look at, touch, and operate the printer, it becomes clear that it is built durably and for keeps, and Memotech is willing to bet a year on its quality. Congratulations, Memotech, on a savvy choice of printer.

The Downside

Well the superlatives have sure been pouring in for the MTX-512 for the past 3000 words or so. The MTX system has once again shown the flair the British have when it comes to designing microcomputers. If you will allow a generalization, it seems they excel in putting together teams of talented individuals—and achieving uncompromised results. I am sure that Memotech is quite proud of its new baby.

What is there, then, to complain about? Well really only a few items, though a couple of those items are of more than passing significance.

Foremost on my list of caveats is the lack of an inexpensive disk drive system controllable from Basic. As it stands, the MTX-512 is a cassette-based system, and the only redress is a \$1300 dual drive system running under CP/M. This is definitely a problem.

Cassette-based storage may be an acceptable proposition to the British hobbyist, but I do not think it will be acceptable in the long-term to the kind of American customer to whom the MTX-512 will appeal. When I was in London, I urged the brass at Memotech to rethink the situation. I guess they agreed, as negotiations are now in progress to OEM a moderately-priced drive from Indus, which will provide random access storage from Basic. (The Indus drive wasn't a tough one for me to think of or to suggest—it is already

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jet black, with a brushed texture, and already exudes quality, as befits any Memotech product. At the same time, it commonly retails for \$420—a far cry from investment in the \$1300 FDX toaster oven. It is very affordable to the hobbyist.)

As to if and when this eventuality will come to pass, that is a sticky one to call. Creating the controller board and drivers should not be such a tough task. However, MTX Basic as it stands has no hooks to anything other than serial-access cassette, and a ROM software revamp could cause additional delays. We shall wait and see.

In fairness, I should report that cassette transfer on the Memotech seems relatively fast and relatively reliable. Audio data "squeal" is routed to the TV speaker to confirm data transfer as with the Atari (but unfortunately not the C-64). Baud rate is selectable to 2400, twice as fast as the Model 100 and more than twice as fast as most other cassette systems.

I admit my unreasonable prejudice, based in large part on traumatic experiences in my past. The problem with cassette systems is that they use cassettes, that's all. I was therefore disappointed to have to use cassettes with the MTX-512. It felt a bit like having an opportunity to drive a

For the price, the MTX-512 is a beauty — inside and out.

Jag—but only up and down the driveway. I couldn't make it to the street.

Another facet of the mass storage snafu is that no FDX was made available to us for evaluation. I saw about a half dozen working units when I was in Oxford, but the U.S. production line had not begun in earnest at the time of this writing. As a result, I can speak definitively only of the MTX itself and the DMX-80 printer—not of the toaster oven. Though I'm sure the FDX will live up to its specs, Memotech did not take advantage of the opportunity to prove it to me.

My other reservations are more nit-picky. The Return key is too small, and I found myself hitting Line Feed all too often by mistake. Maybe I'm a klutz, but I'm also used to Return keys designed for klutzes.

I'm also not so sure about the reset configuration. It seems to me too easy to rest your palms on the machine in such a way as to invoke a cold start, conceivably wiping away a great deal of work (a stroke-inducing phenomenon with which I am all too familiar—if there is a way to screw up hours of work, I will always find it). Though it is a novel approach, I think I would prefer the more conventional recessed back panel reset button.

The documentation, while nearly complete and well-indexed, is rather perfunctory in places. The irony is that here we are with all these wonderful Basic commands to control virtual screens, but without the kind of documentation that really might prepare us to use them in a practical way. I felt the same lack when it came to sprite graphics, sound, drawing, and color commands. The style is uneven. Upon introducing a topic, the documentation treats you like an utter novice (as it should). Then, two pages later, it reads like a college programmer's text. The inconsistency is disconcerting.

The Kicker

If Memotech can straighten out the mass storage situation, it will have in the MTX a very strong contender in the U.S. market. The other criticisms I have made of the unit pale in contrast to its myriad capabilities. The task for Memotech is to make the MTX-512 truly available in the States, so that those of you who are interested can go give it a look, the way I suggested at the top of this piece.

Memotech must also get the machine into the hands of U.S. software houses. I never criticize a new machine for lack of software. But a year from now, the MTX must be supported by the best of U.S. houses, if the hardware is to survive. The British software I saw is, for the most part, a pace behind our own.

Memotech has announced a ROM cart word processor, *New Word*, based on *WordStar*. We did not receive an evaluation copy, but it seemed to work quite well during demos in London. Remember, as it stands, you will be using cassette storage with the package.

American software firms Infocom and MicroProse have announced that they will support the MTX-512. Other companies are expected to follow once the MTX begins to move a bit in this country.

Obviously then, distribution is no trivial concern for imports such as this one. We have watched a number of innovative British machines fall by the wayside in this country not because of competition, but for lack of adequate marketing channels. We have heard potential buyers and software developers tell us they could not find a machine, could not contact manufacturers at numbers we provided, and that when they did manage to get through to someone, the response was uncaring, uncoordinated, and unsure.

We trust that this will not be the case with Memotech, which already has some experience with the U.S. market. And in this extremely important distribution effort, we wish Memotech the greatest success. Like Kate Bush and Bill Nelson, this British import is deserving of a niche on our shores. For the price, the MTX-512 is a beauty—inside and out.

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New Products

Printers

Printers from Alphacom

Alphacom has introduced the Alphapro, an 18 cps daisy wheel printer with proportional spacing and boldface, double-strike, superscripts, subscripts, and strikeout printing. It includes parallel, RS-232, and RS-422 ports. The Alphapro retails for \$399.95.

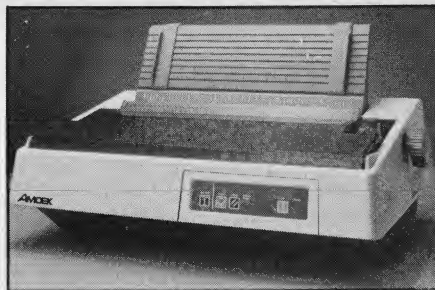
Alphacom also has released the Traveler, a 5.5-pound battery-operated portable thermal printer. It prints at 60 cps and can print 100 pages before needing a recharge. The Traveler sells for \$199.95.

Alphacom Inc., 2323 South Bascom Ave., Campbell, CA 95008. (408) 559-8000.

CIRCLE 400 ON READER SERVICE CARD

Amdek Introduces Letter Quality Printer

The Amdek 5040, a bi-directional 40 cps letter quality daisywheel printer with 2K buffer and parallel and serial ports, has been introduced by Amdek. It prints at 10, 12, or 15 cpi and can handle paper up to 16" wide. Optional double daisywheel print fonts and an automatic single sheet feeder will be available.



The 5040 carries a suggested retail price of \$1695.

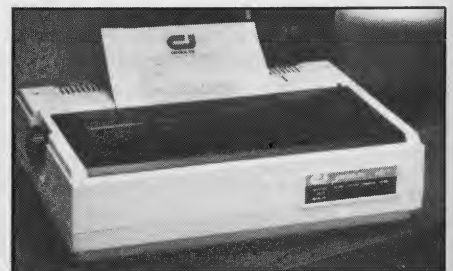
Amdek Corp., 2201 Lively Blvd., Elk Grove Village, IL 60007. (312) 595-6890.

CIRCLE 401 ON READER SERVICE CARD

Letter Quality Printer from Cardco

Cardco has introduced the LQ/1, a 14 cps letter quality printer specially designed for the Commodore 64, although with an adapter, it can also hook up to the IBM PC, PCjr, Radio Shack TRS-80, and other computers. The LQ/1 has friction feed with an optional tractor feed available.

The LQ/1 carries a suggested retail price of \$649.95.



Cardco Inc., 313 Mathewson, Wichita, KS 67214. (316) 267-3807.

CIRCLE 402 ON READER SERVICE CARD

Five Printers from Centronics

Centronics has unveiled five dot-matrix printers, the GLP, Model 351-PC, Printstation 240, Printstation 250, and Model 354.

The GLP (Great Little Printer) weighs 6.6 pounds, measures 13" x 7.5" x 2.8", comes with parallel and RS-232 interfaces and prints at 50 cps draft quality and 12 cps letter quality. It features complete IBM PC compatibility and enlarged, condensed, emphasized, and double-strike text. The GLP retails for \$299.

The Model 351-PC features complete compatibility with the IBM PC, 200 cps draft quality printing, 65 cps proportional near-letter quality printing, and pin-addressable graphics. The Model 351-PC sells for \$2195.

The Printstation 240, a 24-pin printer, features 160 cps draft quality and 80 cps letter quality printing, pin-addressable graphics, and condensed, enlarged, and

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emphasized characters. An optional 132-column version is available. The Printstation 240 lists for \$1495.

The Printstation 250, a bi-directional seven-color printer, features 185 cps proportional, 160 draft quality, and 40 cps letter quality printing. It prints pin-addressable graphics and includes parallel and serial interfaces. The Printstation 250 sells for \$1299.

The Model 354 prints 220 cps in draft quality and 50 cps in correspondence quality and features proportional, bold-face, and shadow printing. The Model 354 carries a suggested retail price of \$2195.

Centronics Data Computer Corp., 1 Wall St., Hudson, NH 03051. (603) 883-0111.

CIRCLE 403 ON READER SERVICE CARD

IBM PC Printer from CIE Terminals

CIE Terminals has unveiled the Model 20, an IBM PC compatible version of its CI-3500 series dot matrix printers. The Model 20 prints at 350 cps draft quality and 87.5 cps letter quality in text mode and includes boldface, italics, superscript and subscript printing. Removable type font cartridges are available. Graphics resolution is 240 x 144 dots per inch.

The Model 20 sells for \$1995.

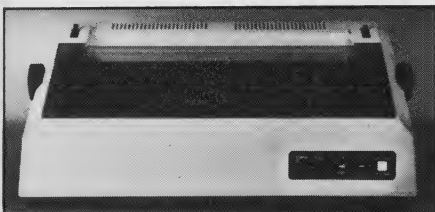
CIE Terminals Inc., 2505 McCabe Way, Irvine, CA 92714. (714) 660-1421.

CIRCLE 404 ON READER SERVICE CARD

Printers from C. Itoh

C. Itoh has introduced six printers: the A-10, Y-10, 75000E, 8510SCE, 1550SCE, and 1570.

The 15 cps Y-10 and 30 cps A-10 are daisy wheel printers with 100-character plastic print wheels, either RS-232C or



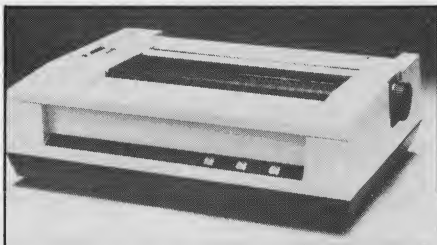
parallel interfaces, and proportional spacing. The Y-10 has friction feed only; the A-10 includes tractor feed, the Y-10 sells for \$550, the A-10 \$795.



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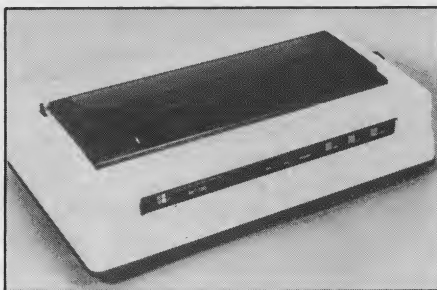
The 7500E is a bi-directional 105 cps dot matrix printer with friction and tractor feed, 2K buffer, and parallel interface. The 7500E retails for \$450.

The 8510SCE and 1550SCE dot matrix printers print at 180 cps draft quality and 120 cps correspondence quality,



are available with parallel or RS-232C serial interfaces, and include 4K serial or 2K parallel buffers. The 8510SCE is an 80 column printer, the 1550SCE an 136 column printer. The 8510SCE retails for \$940, the 1550SCE for \$1270.

The 1570 seven-color dot matrix printer features a 24-pin print head, prints at 180 cps draft quality and 120



cps letter quality, and includes a 24K buffer. Parallel and RS-232C interfaces are available, and it prints 136 columns across. The 1570 sells for \$2000.

C. Itoh Electronics Inc., 5301 Beethoven St., Los Angeles, CA 90066. (213) 306-6700.

CIRCLE 405 ON READER SERVICE CARD

Dot Matrix Printer from Diablo

Diablo Systems has unveiled the P32CQI, a nine-pin bi-directional 150 cps dot matrix printer. It prints graphics as well as emphasized, double strike, underlined, condensed, elite, enlarged, superscript, and subscript text.

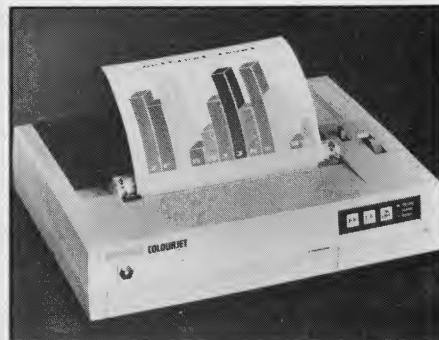
The P32CQI sells for \$995.

Diablo Systems Inc., P.O. Box 5030, Fremont, CA 94537. (415) 498-7000.

CIRCLE 406 ON READER SERVICE CARD

Color Ink Jet Printer from Integrex

The Colorjet 132, a bi-directional 36-color ink jet printer, has been introduced



by Integrex. The Colorjet 132 prints 2600 dots per second in graphics mode and 40 cps intext mode and includes a 231-character ASCII character set plus 128 block graphics characters.

The Colorjet 132 carries a suggested retail price of \$795.

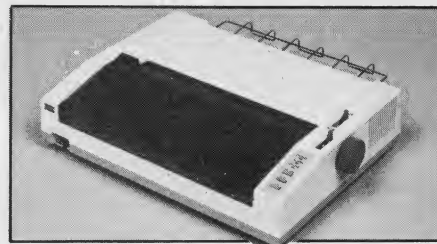
Integrex Inc., 233 North Juniper St., Philadelphia, PA 19017. (215) 568-9681.

CIRCLE 407 ON READER SERVICE CARD

180 cps Dot Matrix Printer from Fujitsu

Fujitsu America has released the Daisywriter Matrix 9, a bidirectional, nine-pin, 80-column dot matrix printer. It prints at 180 cps draft quality and 25 cps in correspondence quality, and can print international characters, superscripts, and subscripts. Additional 255-character fonts can be downloaded.

The Daisywriter Matrix 9 comes with friction and tractor feeds. A Centronics parallel interface is standard, and an RS-



232C serial interface is optional.

The Daisywriter Matrix 9 carries a suggested retail price of \$695.

Fujitsu America Inc., 3055 Orchard Dr., San Jose, CA 95134. (408) 946-8777.

CIRCLE 408 ON READER SERVICE CARD

MPI Introduces Portable Printer

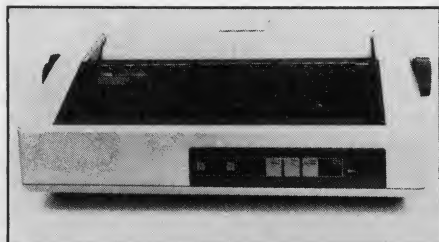
The Sprinter, a 160 cps, bi-directional dot matrix printer that comes with a travel cover has been introduced by Micro Peripherals. Weighing in at 16 pounds, the Sprinter includes a parallel port, friction and tractor feed, and a 4K buffer expandable to 68K.



The Sprinter sells for \$595. Micro Peripherals Inc., 4426 South Century Dr., Salt Lake City, Ut 84123. (801) 263-3081 or (800) 821-8848. CIRCLE 409 ON READER SERVICE CARD

NEC Releases 55 cps Letter Quality Printer

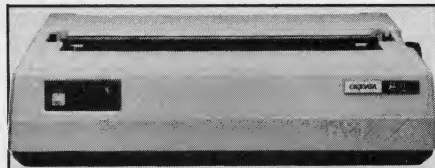
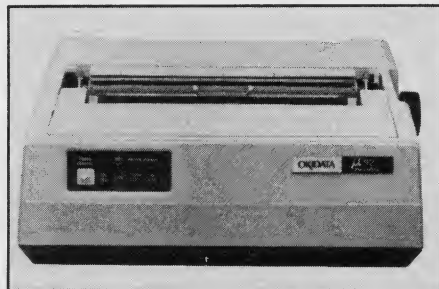
NEC has introduced the Spinwriter 8850, a 55 cps bi-directional letter quality printer compatible with the IBM PC and other NEC Spinwriter printers. It features automatic proportional spacing, bold and shadow printing, and a selection of over 60 character sets on print timbles.



The Spinwriter 8850 retails for \$2495. NEC Information Systems Inc., 1414 Massachusetts Ave., Boxborough, MA 01719. (617) 264-8000. CIRCLE 410 ON READER SERVICE CARD

Okidata Printers for Apple

Okidata has released versions of its Microline 92 and 93 dot matrix printers for use with the Apple IIe, Macintosh,

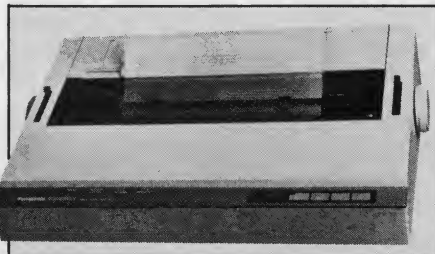


and Lisa II computers. Okidata, 532 Fellowship Rd., Mt. Laurel, NJ 08054. (609) 235-2600. CIRCLE 411 ON READER SERVICE CARD

Four New Printers from Panasonic

Panasonic has introduced one daisy-wheel printer, the KX-P3151, and three dot matrix printers, the KX-P1091, KX-P1092, and KX-P1093.

The KX-P3151 is bi-directional, Diablo-compatible, and includes a 96-



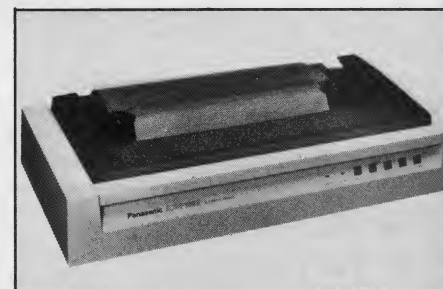
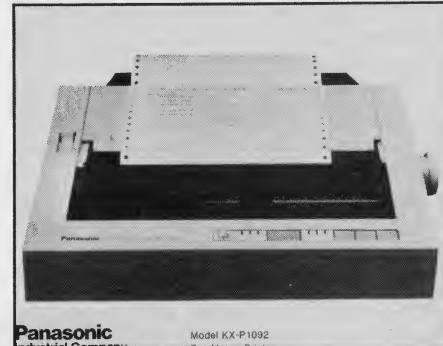
character printwheel. It prints at 22 cps, supports bold and shadow printing, and checks for paper end, ribbon end, and other errors. It uses standard friction feed, optional tractor feed, or single sheet feed.

The KX-P1091 uses a nine-pin head, is bi-directional, and prints at 120 cps. It features an adjustable tractor feed and



friction feed and includes a parallel interface. An optional serial interface is available.

The KX-P1092 also uses a nine-pin head and is bi-directional, but prints at 180 cps. It features three print modes—draft quality, near letter quality, and graphics. It includes tractor and friction feed and a parallel interface. An optional RS-232C interface is available.



The KX-P1093 uses a nine-pin head, is bi-directional, and prints at 160 cps in pica type and 135 cps in elite type. It features four print modes—draft quality, near letter quality, graphics, and proportional. It includes tractor and friction feed and a parallel interface. An optional RS-232C interface is available.

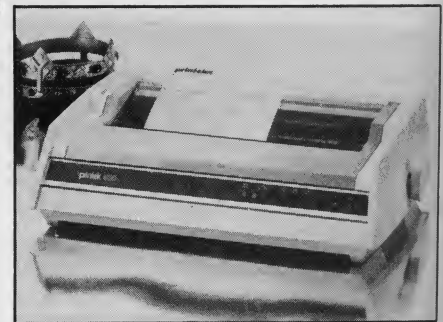
The KX-P3151 retails for \$699, the KX-P1091 \$499, the KX-P1092 \$599, and the KX-P1093 \$899.

Panasonic, One Panasonic Way, Secaucus, NJ 07094. (201) 348-7000.

CIRCLE 412 ON READER SERVICE CARD

Printek Expands Printer Line

Printek has introduced the 930 Executive Printer, a 200 cps draft quality and 80 cps letter quality dot matrix printer. The 930 includes friction and tractor feed, Diablo emulation, and parallel and



serial interfaces. It also prints dual density graphics.

The 930 lists for \$1995.

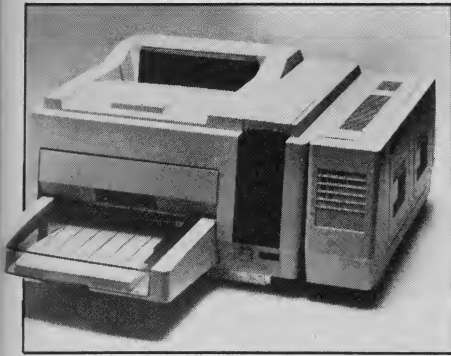
Printek Inc., 1517 Towline Rd., Benton Harbor, MI 49022. (616) 925-3200.

CIRCLE 413 ON READER SERVICE CARD

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Ricoh Unveils Two Printers

Ricoh has introduced the RP2200Q, a 20 cps daisy wheel serial printer, and the LP4120, a laser printer that prints 12 pages per minute, or roughly 3000 cps.



The LP4120 includes four type fonts and RS-232C and RS-422 interfaces.

The RP2200Q sells for \$739 and the LP4120 for \$9950.

Ricoh Corp., 5 Detrick Pl., West Caldwell, NJ 07006. (201) 882-2000.

CIRCLE 414 ON READER SERVICE CARD

Ink Jet Printer from Tandy

Tandy has introduced the TRS-80 CGP-220, a seven-color ink jet printer for TRS-80 computers. The CGP-220 prints 2600 dots per second in graphics mode with a resolution of 640 dots per line and 37 cps in text mode.



The CGP-220 carries a suggested retail price of \$699. Black Ink Pack cartridges cost \$9.95 and Tri-Color Ink Pack cartridges cost \$14.95.

Tandy Corp., 1800 One Tandy Center, Fort Worth, TX 76102. (817) 390-3700.

CIRCLE 415 ON READER SERVICE CARD

TI Dot Matrix Printer

Texas Instruments has introduced the Omni 800 Model 855, a 150 cps draft quality and 35 cps letter quality dot matrix printer for the TI Professional and 1985 Creative Computing Buyer's Guide

most other personal computers. Up to three different type font cartridges can plug into the Model 855 at once.

The Model 855 with friction feed costs \$935, tractor feed \$995.

Texas Instruments, Data Systems Div., P.O. Box 402430, Dallas, TX 75240. (800) 527-3500.

CIRCLE 416 ON READER SERVICE CARD

Printer Buffer and Controller from Applied Creative Technology

Printer Optimizer, a combination buffer and controller for parallel printers, has been released by Applied Creative Technology. It uses a Z80 microprocessor, includes 64K RAM as standard, expands to 256K, and controls up to three printers. It has a pause control, selective printing function, and can access the special effects of the printers.

Printer Optimizer carries a base price of \$499.

Applied Creative Technology Inc., 2156 W. Northwest Hwy., Suite 303, Dallas, TX 75220. (214) 556-2916 or (800) 433-5373.

CIRCLE 417 ON READER SERVICE CARD

Big Foot Printer Buffer from Digital Devices

Digital Devices has released Big Foot, a buffer for printers with Centronics par-

allel input and output interfaces. Big Foot comes in three models: P16, with 16K of memory, \$89.95; P32, with 23K, \$129.95; and P64, \$179.95.

Digital Devices Corp., 430 10th St., Atlanta, GA 30318. (404) 872-4430 or (800) 554-4898.

CIRCLE 418 ON READER SERVICE CARD

Three Printer Buffers from JVC

JVC Electronics has introduced three models of the Spool-Z-Q, a standalone buffer for printers using Centronics parallel interfaces. Spool-Z-Q uses a Z80A microprocessor, has its own power sup-



ply, and connects between the computer and printer. It features a pause control and a clear buffer function.

The 32K Spool-Z-Q sells for \$219, the 64K model for \$249, and the 128K model for \$309.

JVC Electronics, 1601 Fulton Ave., Suite 10A, Sacramento, CA 95825. (916) 483-0709.

CIRCLE 419 ON READER SERVICE CARD

Monitors

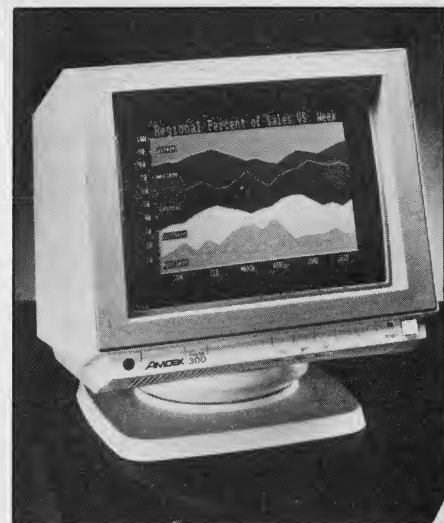
Amdek Composite Color Monitor

The Color 300, a 13" composite color monitor from Amdek, has a graphics resolution of 260 dots by 300 lines and a text resolution of 25 lines of 40 characters. An optional swivel and tilt pedestal is available.

The Color 300 carries a suggested retail price of \$350.

Amdek Corp., 2201 Lively Blvd., Elk Grove Village, IL 60007. (312) 595-6890.

CIRCLE 420 ON READER SERVICE CARD



RGB Color Monitor from Apple

Apple Computer has introduced the AppleColor 100, a 12" RGB color monitor for use with the Apple IIe, III, and III Plus. It features screen tilting and a "green only" monochrome switch to turn off the color. The AppleColor 100 requires the Extended 80-Column Text/AppleColor Card, a plug-in board that provides RGB color output, supports 80-column text display, and comes with 64K RAM.

Apple also plans to introduce a RGB adapter to allow IIc owners to use the AppleColor 100 later in 1984.

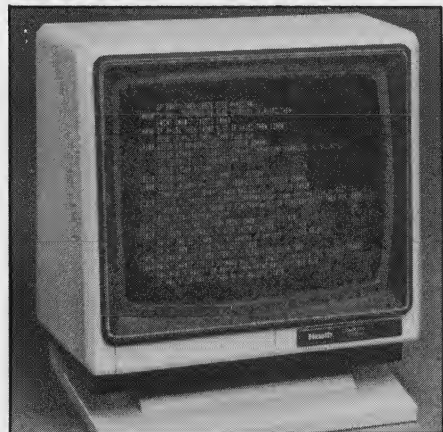
The AppleColor 100 carries a suggested retail price of \$599. The Extended 80-Column Text/AppleColor Card sells for \$299.

Apple Computer Inc., 20525 Mariani Ave., Cupertino, CA 95014. (408) 996-1010.

CIRCLE 421 ON READER SERVICE CARD

Build-It-Yourself Monitor from Heathkit

Heathkit has introduced the HVM-122A, a 12" monochrome amber screen monitor users assemble from a kit. It accepts NTSC composite signals and dis-



plays a text resolution of 25 lines of either 40 or 80 characters. An optional swivel and tilt pedestal is available.

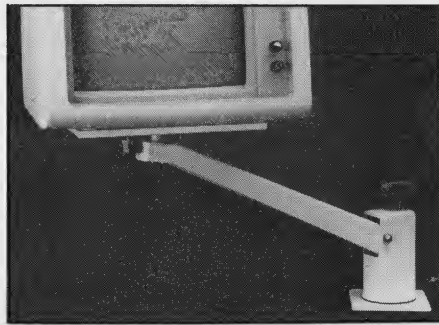
The HVM-122A retails for \$89.95.

Heath Co., Benton Harbor, MI 49022. (616) 982-3210.

CIRCLE 422 ON READER SERVICE CARD

Monitor Mover

Lintek has released the Monitor Mover, an adjustable mechanical arm to lift most monitors up and off a desk. It consists of a CRT mounting tray that



can be tilted up to 15 degrees, a 15" arm, 360-degree swivel base, and desk clamp.

The Monitor Mover retails for \$149.95.

Lintek Computer Accessories, P.O. Box 8056, Grand Rapids, MI 49508. (616) 241-4040.

CIRCLE 423 ON READER SERVICE CARD

Flat Panel Display from PlasmaGraphics

PlasmaGraphics has unveiled the 120, a compact 7" x 10" x 1.5" flat panel monitor using gas discharge technology. The screen has graphics resolution of 480 x 250 pixels and text resolution of 25 lines of 80 characters.

The PlasmaGraphics 120 retails for \$1795.

PlasmaGraphics Corp., P.O. Box 4903, Mt. Bethel Rd., Warren, NJ 07060. (201) 757-5000.

CIRCLE 424 ON READER SERVICE CARD

Amber Monochrome Monitor from Quadram

The Amberchrome, a 12" amber monochrome monitor with graphics resolution of 720 dots x 350 lines and text resolution of 25 lines of 80 characters, has been announced by Quadram.



Amberchrome carries a suggested retail price of \$250.

Quadram Corp., 4355 International Blvd., Norcross, GA 30093. (404) 923-6666.

CIRCLE 425 ON READER SERVICE CARD

Monitor-TV Tuner

Taxan has introduced the Model 305 Television Tuner, which converts a composite monitor with audio into a color television. Taxan contends that a



monitor-turned-television displays a clearer picture than a regular television.

The Model 305 Tuner retails for \$129.95.

Taxan Corp., 18005 Cortney Ct., City of Industry, CA 91748. (818) 810-1291.

CIRCLE 426 ON READER SERVICE CARD

Four Monitors from Sakata

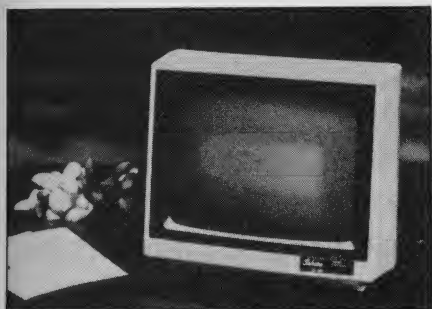
Sakata has introduced the SC-100, a 13" composite color monitor with a graphics resolution of 280 lines by 300



lines and a text resolution of 25 lines of 40 characters. It includes an audio speaker with earphone jack and is compatible with the Apple II series, Commodore 64 and Vic 20, IBM PCjr and other computers. The SC-100 carries a suggested retail price of \$329.

The SC-200 and SC-300, 13" RGB color monitors, display 16 colors and a text resolution of 25 lines of 80 characters. Both are compatible with the IBM PC, Apple II and III, NEC PC, and other computers. The SC-200 retails for \$649, the SC-300 for \$899.

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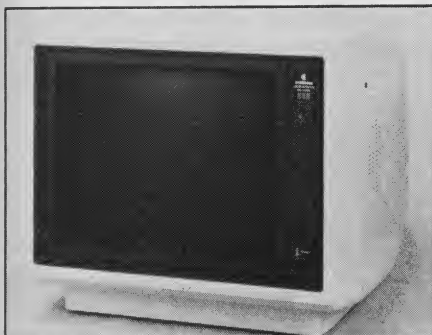
Sakata also released the SA-1000, a 12" monochrome amber screen monitor with a resolution of 900 dots center by 800 dots corner and a text resolution of 25 lines of 80 characters. The SA-1000 sells for \$159.

Sakata USA Corp., 651 Bonnie Ln., Elk Grove Village, IL 60007. (312) 593-3211 or (800) 323-6647.

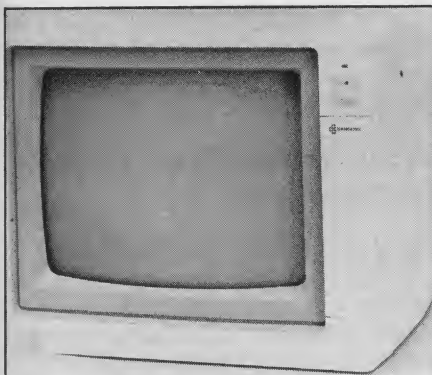
CIRCLE 427 ON READER SERVICE CARD

Color Monitors from Samsung

Samsung has released the CD-1251F, a 12" color monitor with graphics resolution of 615 dots by 225 lines and text resolution of 25 lines of 80 characters;



the CD-1452F, a 14" color monitor with graphics resolution of 720 dots by 225 lines and text resolution of 25 lines of 80 characters; and the CD-1451D, a



14" composite color monitor with graphics resolution of 300 dots by 330 lines and text resolution of 25 lines of 40 characters.

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Prices for the CD-1251F, the CD-1452F and the 1451D have not been set. Samsung Electronics America Inc.,

117 Seaview Dr., Secaucus, NJ 07094. (201) 867-7575.

CIRCLE 428 ON READER SERVICE CARD

Disk Drives

Macintosh Winchester from Davong

Davong has introduced the Mac Disk series of Winchester hard disk drives for the Apple Macintosh in 10Mb, 21Mb, 32Mb, and 40Mb versions. The 10Mb Mac Disk carries a suggested retail price of \$2395; the 21Mb, \$3295; the 32Mb, \$3995; and 40Mb, \$4495.

Davong Systems Inc., 217 Humboldt Ct., Sunnysvale, CA 94089. (408) 734-4900.

CIRCLE 429 ON READER SERVICE CARD

30 Mb Hard Disk Drive for IBM PC

Falcon Technology has added a 30Mb hard disk drive to its PC eXTender line of drives for the IBM PC. The drive includes a clock/calendar, serial port, and sockets for 192K RAM on the controller board.



The 30Mb model carries a suggested retail price of \$3995.

Falcon Technology Inc., 6644 South 196th St., Suite T-101, Kent, WA 98032. (206) 251-8282 or (800) 722-2510.

CIRCLE 430 ON READER SERVICE CARD

Hard Disk Drive and Tape Backup from Mountain

Mountain Computer has introduced a line of external hard disk drives and backup tape drives for the IBM PC and Apple II+, IIe, and III. Four hard disk drives, with a capacity of 10, 15, 20, and 35Mb, come with a 27Mb backup tape



drive. The 20 and 35Mb drives can also be packaged with a 60Mb backup tape drive.

Prices for the hard disk drive and backup tape drive packages range from \$4195 to \$5795.

Mountain Computer Inc., 300 El Pueblo Rd., Scotts Valley, CA 95066. (408) 438-6650.

CIRCLE 431 ON READER SERVICE CARD

Internal Hard Disk Drives for IBM PC

Maynard Electronics has introduced the Apollo, a 30Mb internal hard disk drive for the IBM PC. The drive, controller card, and power supply retails for \$2995.

Maynard also introduced the Gemini, a half-height 10Mb internal hard disk drive with optional half-height floppy or hard drive. The Gemini drive and controller card sell for \$1395. An optional half-height double sided, double

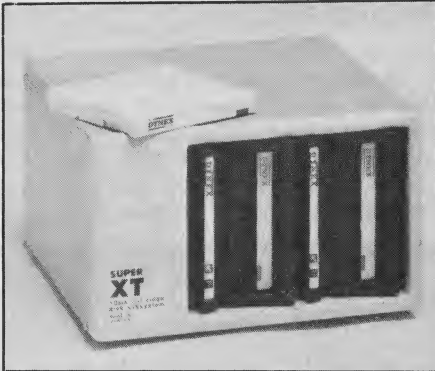
density 360K floppy disk drive costs \$295.

Maynard Electronics, 400 E. Semoran Blvd., Casselberry, FL 32707. (305) 331-6402.

CIRCLE 432 ON READER SERVICE CARD

Hard Disk Drive for IBM PC

Datrex has released the Super XT Cartridge Disk Subsystem, two external 5Mb Winchester hard disk drives with



removable cartridges for the IBM PC.

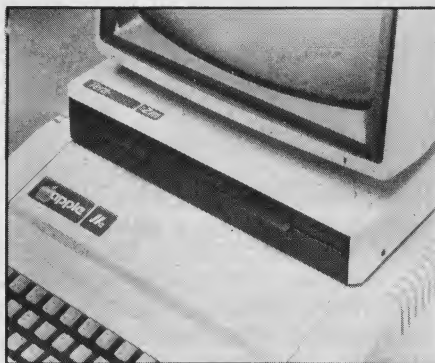
The Super XT Cartridge Disk Subsystem retails for \$1995.

Datrex Inc., 3536 W. Osborn Rd., Phoenix, AZ 85019 (602) 272-9491.

CIRCLE 433 ON READER SERVICE CARD

Floppy Disk Drives for Apple

Eicon Research has announced the Tera-Drive, a 1Mb, 5.25" floppy disk drive for the Apple II+ and IIe. The



Tera-Drive supports DOS 3.3 and CP/M.

One Tera-Drive sells for \$995, two for \$1595.

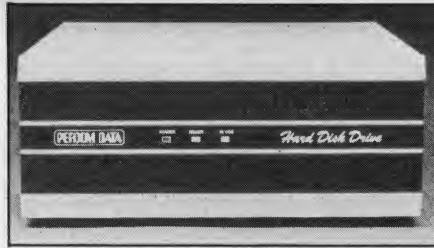
Eicon Research Inc., 520 Fifth Ave. PH, New York, NY 10036. (212) 719-5353.

CIRCLE 434 ON READER SERVICE CARD

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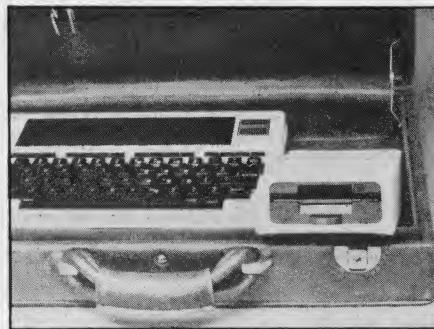
Percom Data Adds Disk Drives and Backup Tape System

Percom Data has released the PHD-20, a 20Mb hard disk drive for the IBM PC and compatibles, Apple computers, and



TRS-80 computers. It retails for \$2195.

Percom also introduced a 360K, battery-powered portable 3.5" disk drive for



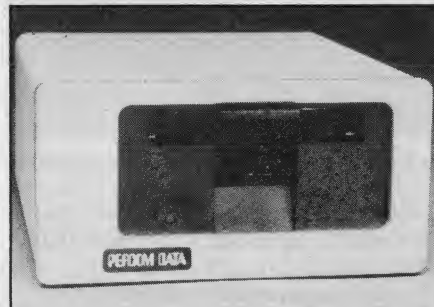
the Tandy TRS-80 Model 100. The cost has not been set.

The AT-88 SPD, a 176K 5.25" floppy disk drive for the Atari home computers, was announced by Percom. It includes



an internal controller and that can connect to three slave drives. The AT-8088 SPD lists for \$419.

Percom Data also introduced an 11Mb backup tape drive for its PHD



Winchester hard disk drives. The backup tape system is compatible with MS-DOS 2.0 or higher and lists for \$995.

Percom Data Corp., 11220 Pagemill Rd., Dallas, TX 75243. (214) 340-7081.

CIRCLE 435 ON READER SERVICE CARD

Half-Height Winchester Hard Disk Drive from Qume

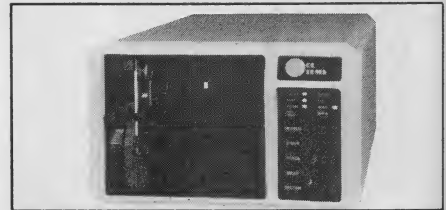
Qume has released half-height 10Mb, 20Mb, and 30Mb Winchester hard disk drives featuring rotary actuator, micro-processor control, and track-following servo. The 10Mb model sells for \$600, the 20Mb model for \$770, and the 30Mb model for \$870 in quantities of 500.

Qume, Memory Products Div., 2350 Qume Dr., San Jose, CA 95131. (408) 942-4000.

CIRCLE 436 ON READER SERVICE CARD

Sunol Expands Hard Disk Drive Line

Sunol has added a 92Mb hard disk drive to their line. The 92Mb drive is compatible with more than 20 different microcomputers, including IBM PC and



compatibles, Apple II series, Apple Macintosh, TRS-80 Models I, II, and III, and TI Professional. An optional backup tape drive is available.

The 92Mb hard disk drive lists for \$6695; with optional backup tape drive, \$8050.

Sunol Systems, 1072 Serpentine Ln., Pleasanton, CA 94566. (415) 484-3322.

CIRCLE 437 ON READER SERVICE CARD

Winchester Disk Drives for Macintosh

Tecmar has introduced the MacDrive, a Winchester disk drive for the Apple Macintosh. Four versions are available: model 73010 with a 5Mb removable cartridge priced at \$1995; model 73020 with two 5Mb removable cartridges for \$3290; model 73020 with a 10Mb fixed disk for \$1995; and model 73210 with a 10Mb fixed hard disk and 5Mb removable cartridge for \$3290. Each 5Mb

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cartridge costs \$120.

Tecmar Inc., 6225 Cochran Rd., Solon (Cleveland), OH 44139. (216) 349-0600.

CIRCLE 438 ON READER SERVICE CARD

Winchester Drive for TI Pro

Texas Instruments has introduced an internally mounted 18.2Mb Winchester

hard disk drive for the TI Professional Computer. It has an average access time of 40 ms, twice as fast as the current 10Mb Winchester.

The 18.2Mb drive, including controller board, cables, and diagnostics software, carries a suggested retail price of \$2995.

Texas Instruments Inc., Data Systems Group, P.O. Box 809063, Dallas, TX 75380, (800) 527-3500.

CIRCLE 439 ON READER SERVICE CARD

Modems

Auto-Dial Modem from Cermetek

Cermetek has introduced the Info-Mate 1200, a Hayes-compatible, auto-dial, auto-answer 1200 baud modem geared for business users. The Info-Mate runs Crosstalk, PC Talk, and Smartcom



II software, features voice and data switching, and supports synchronous communication with mainframe computers.

The Info-Mate carries a suggested retail price of \$595.

Cermetek Microelectronics Inc., 1308 Borregas Ave., P.O. Box 3565, Sunnyvale, CA 94088. (408) 752-5000.

CIRCLE 440 ON READER SERVICE CARD

Internal Modem for IBM PC

Delta Communication has introduced the Xcom Modem, a 300 and 1200 baud internal modem for the IBM PC featuring automatic dialing and answering, ring-back signal detection, touchtone or rotary dialing, and compatibility with AT&T 103, 113, and 212A modems. Delta includes the Crosstalk XVI com-



munications software with the Xcom modem.

Xcom carries a suggested retail price of \$449.

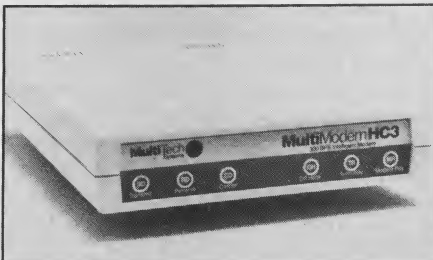
Delta Communication Products Inc., 3213 Ramos Circle, Sacramento, CA 95827. (916) 366-7071.

CIRCLE 441 ON READER SERVICE CARD

MultiModem Line from Multi-Tech

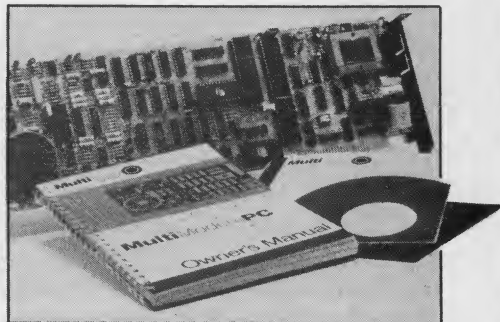
Multi-Tech Systems has released three desktop and two internal modems. The 300 and 1200 baud desktop MultiModem combines features of the Hayes Smartmodem 1200 with internal number storage and dial and busy tone detection.

The 300 and 1200 band desktop MultiModem HC3 features 100 percent



Hayes Smartmodem emulation.

The 300 and 1200 internal MultiModem PC fits into the IBM PC, while the 110 and 300 baud internal MultiModem IIE plugs into an Apple II, II+, or IIE. Both internal modems include communications software. All five MultiModems include free on-line time on CompuServe and NewsNet.



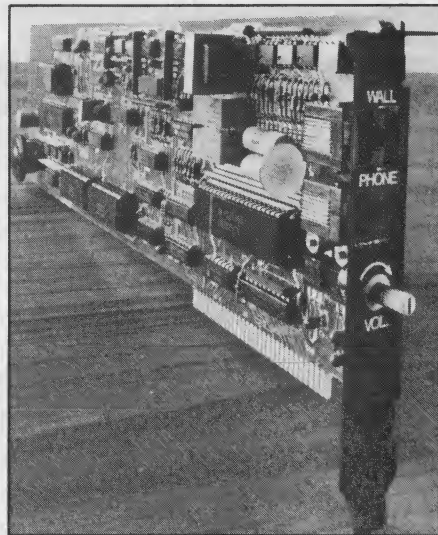
The MultiModem, MultiModem HC, and MultiModem PC retail for \$549 each, the MultiModem IIE for \$329, and the MultiModem HC3 for \$289.

Multi-Tech systems Inc., 82 Second Ave. SE, New Brighton, MN 55112. (612) 631-3550.

CIRCLE 442 ON READER SERVICE CARD

Internal Modem for IBM PC and Compatibles

The Popcom C100, a new internal 300 and 1200 baud modem from Prentice, features automatic voice and data



switching, automatic dial, and full compatibility with AT&T 103, 113, and 212A dial-up modems. The C100 retails for \$445.

Prentice Corp., 266 Caspian Dr., P.O. Box 3544, Sunnyvale, CA 94088. (408) 734-9810.

CIRCLE 443 ON READER SERVICE CARD

Prometheus Introduces 1200 Baud Modem

The ProModem 1200, a 300 and 1200 baud desktop modem from Prometheus, features automatic dialing and answering, touchtone and rotary dialing, voice and data switching, and compatibility



with Hayes and AT&T 212A modems. Up to four optional 16K buffer cards can be installed in the ProModem.

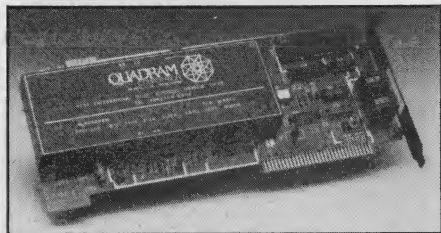
ProModem carries a suggested retail price of \$495. Buffer cards with 16K list for \$99.

Prometheus Products Inc., 45277 Fremont Blvd., Fremont CA 94538. (415) 490-2370.

CIRCLE 444 ON READER SERVICE CARD

Quadmodem from Quadram

The Quadmodem, a 300 and 1200 baud modem by Quadram, features automatic dial and answer, AT&T 103 and 212A compatibility, and tone or pulse dialing. Internal and external versions are available.



The internal Quadmodem sells for \$595, the external model for \$695.

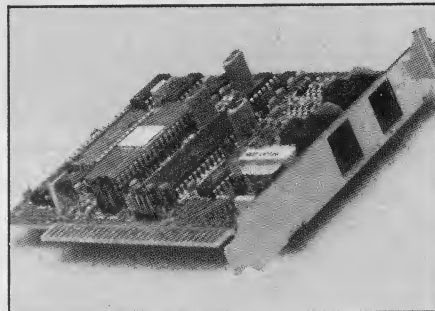


Quadram, 4355 International Blvd., Norcross, GA 30093. (404) 923-6666.

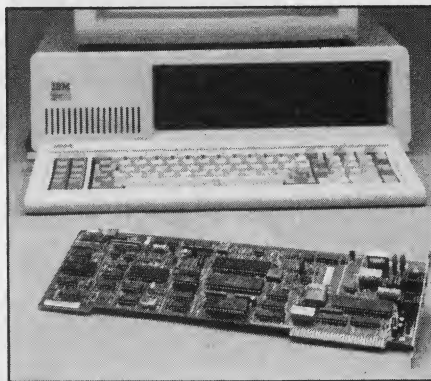
CIRCLE 445 ON READER SERVICE CARD

Four Modems from Racal-Vadic

Racal-Vadic has unveiled the Maxwell Modem line of modems: the 300V, a 300 baud desktop modem selling for \$350; the 1200V, a 1200 baud desktop model for \$595; the 300PC, a 300 baud internal modem for the IBM PC for \$325; and



the 1200PC, a 1200 baud internal modem for the IBM PC for \$595.



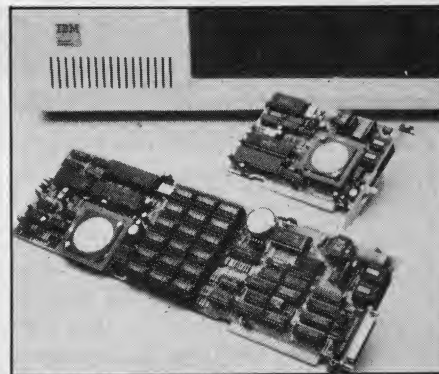
Racal-Vadic also sells the George communications software for \$95.

Racal-Vadic, 1525 McCarthy Blvd., Milpitas, CA 95035. (408) 946-2227.

CIRCLE 446 ON READER SERVICE CARD

US Robotics Unveils Internal Modems for IBM PC

US Robotics has introduced the Personal Communicator, an internal 300 and 1200 baud modem featuring automatic dialing, automatic answering and



voice and data switching. An enhanced model adds a parallel port, clock, and 64K RAM and a top-of-the-line model includes 256K RAM. US Robotics includes its Telpac communications software with the modem.

The Personal Communicator sells for \$499, the 64K model for \$699, and the 256K model for \$999.

US Robotics Inc., 1123 W. Washington Blvd., Chicago, IL 60607. (312) 733-0497.

CIRCLE 447 ON READER SERVICE CARD

Memory

PCjr Memory Board

Quadram has introduced the Quadmemjr, a memory expansion board for the IBM PCjr. The Quadmemjr accepts 64K chips or 256K chips, which makes its memory either 64K, expandable to 128K, or 256K, expandable to 512K. Quadmemjr comes with software to set up a RAMdisk and print spooler.

Quadmemjr costs \$375 for 128K, \$695 for 256K, and \$1395 for 512K.

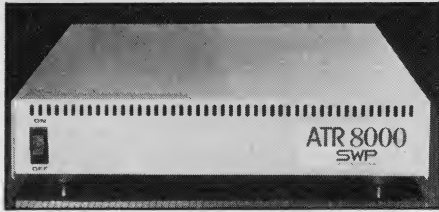
Quadram Corp., 4355 International Blvd., Norcross, GA 30093. (404) 923-6666.

CIRCLE 448 ON READER SERVICE CARD

16-bit Co-Processor from SWP

SWP Microcomputer has announced Co-Power-88, a 16-bit 8088 co-processor with either 128K or 256K RAM for the Kaypro, Xerox 820, Bigboard, Osborne I, and SWP ATR8000. Co-Power-88

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Compaq 256K RAM Chip

Compaq has announced the availability of 256K RAM chips for the main system board of the Compaq portable and Compaq Plus computers. The chips boost the main system board RAM to 640 K, which saves users an expansion slot that normally holds a plug-in memory board.

Compaq dealers will install the new chips, which carry a suggested retail price of \$650 per 256K.

Compaq Computer Corp., 20333 FM149, Houston, TX 77070. (713) 370-7040.

CIRCLE 450 ON READER SERVICE CARD

runs MS-DOS 2.11 or optional CP/M-86 and includes software to set up a RAM disk.

The Co-Power-88 with 128K sell for \$400, with 256K for \$500.

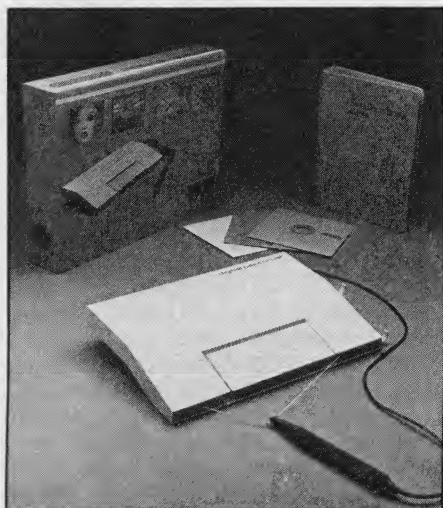
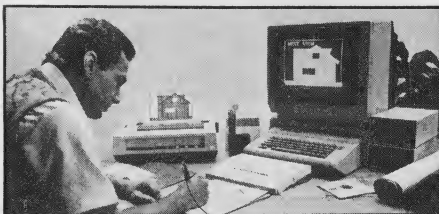
SWP Microcomputer Products Inc., 2500 E.Randol Mill Rd., Suite 125, Arlington, TX 76011. (817) 861-0421.

CIRCLE 449 ON READER SERVICE CARD

Graphics & Sound

Color Graphics Package for Apple

The Computer Colorworks has introduced the Digital Paintbrush System, a high-resolution digitizing pen coupled with extensive graphics software. The pen attaches to two rotating potentiometers inside the case. As the pen moves across a pad, the drawing is sent to the



monitor screen. Images can be sent to a printer and two users in separate locations can edit an image over a modem.

The Digital Paintbrush System retails for \$299.

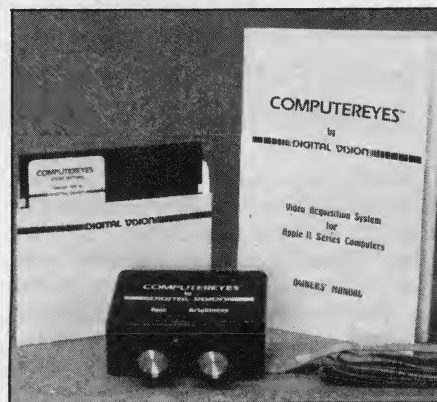
The Computer Colorworks, 3030 Bridgeway, Suite 201, Sausalito, CA 94965. (415) 331-3022.

CIRCLE 451 ON READER SERVICE CARD

Video Acquisition System for Apple II

Digital Vision has unveiled Computereyes, a slow scan device connecting between a video camera or videodisc and the Apple game I/O socket. Computereyes takes a real-world image from the video source and places it on a high-resolution monitor in gray scale. Images can be sent to a printer.

Computereyes, including software and cable, retails for \$129.95. A complete



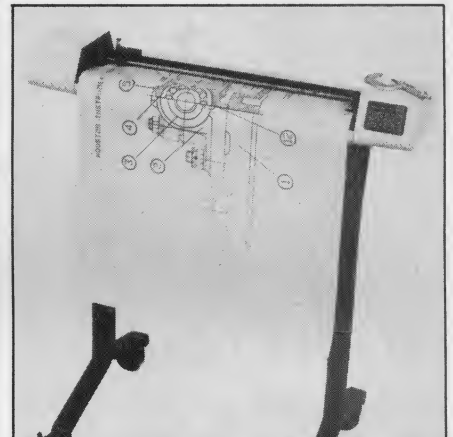
system, including video camera, sells for \$349.95.

Digital Vision Inc., 14 Oak St., Suite 2, Needham, MA 02192. (617) 444-9040.

CIRCLE 452 ON READER SERVICE CARD

High Speed Plotters from Houston Instrument

Houston Instrument has introduced the DMP-51, a plotter with 4G acceleration, a high speed of 22 inches per second, and a resolution of .001 inches. The DMP-51 is intended for engineering, scientific, surveying, business, and geophysical drafting. A mechanical/



architectural version, the DMP-52, is also available.

The DMP-51 and DMP-52 carry a suggested retail price of \$4495.

Houston Instrument, 8500 Cameron Rd., Austin, TX 78753. (513) 835-0900 or (800) 531-5205.

CIRCLE 453 ON READER SERVICE CARD

Muppets from Koala

Koala Technologies has introduced the Muppet Learning Keys, a computer



keyboard for children ages three and up. The Muppet Learning Keys will teach the alphabet, numbers, colors, and shapes and is available for the Apple IIe and IIc and Commodore 64.

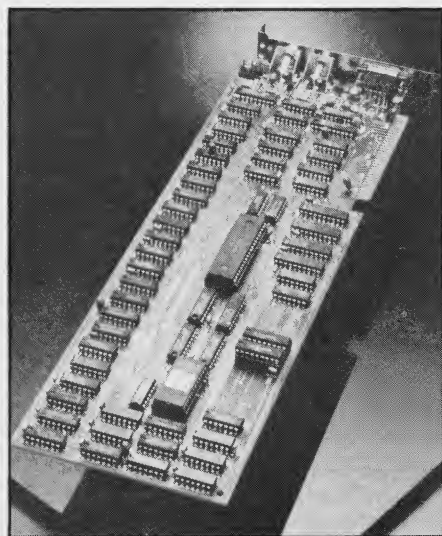
Muppet Learning Keys retails for \$79.95.

Koala Technologies Corp., 3100 Patrick Henry Dr., Santa Clara, CA 95052. (408) 986-8866.

CIRCLE 454 ON READER SERVICE CARD

Color Graphics Adapter for IBM PC

Multitech has introduced the CGA-PC/I color graphics adapter for the IBM PC and compatibles. Graphics resolution is 320 x 200 pixels with four colors and text resolution is either 80 x



25 or 40 x 25. The CGA-PC/I has RGB, composite color, and light pen interfaces.

The CGA-PC/I costs \$170 and is available through US distributors.

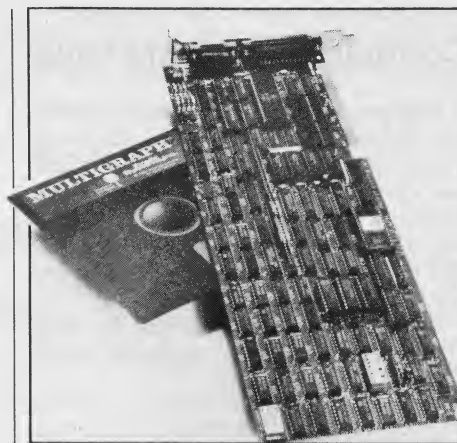
Multitech Industrial Corp., 9 FL, 266, Sung Chiang Rd., Taipei 104, Taiwan, (02) 551-1101.

CIRCLE 455 ON READER SERVICE CARD

Graphics Board From Profit Systems

Multigraph, a graphics board for use with a color or monochrome monitor, has been introduced by Profit Systems. Resolution is up to 720 x 700 pixels in monochrome and 640 x 400 pixels with 16 colors. Multigraph also features 32K on board RAM, flicker free scrolling, 32-bit internal architecture, and optional printer port.

The Multigraph carries a base price of \$499 for monochrome only. Optional color and increased monochrome resolu-



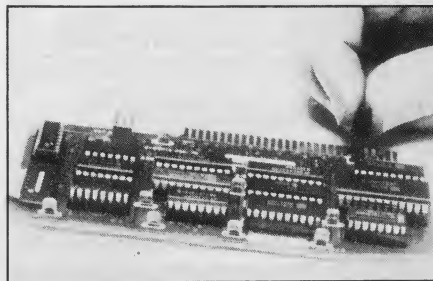
tion boards that piggyback onto the original board cost \$340. The printer port costs \$65.

Profit Systems Inc., 30150 Telegraph Rd., Birmingham, MI 48010. (313) 647-5010.

CIRCLE 456 ON READER SERVICE CARD

RGB Board For Apple IIe

Sakata has introduced the XB-7, A RGB color graphics board for Apple IIe that displays two color text in 80 column mode, 16 color text in 40 column mode, and ability to add text in 40 column mode to 16 color graphics. RGB text



color of green, amber, blue, or white is selected through switches on the XB-7.

The XB-7 retails for \$249.

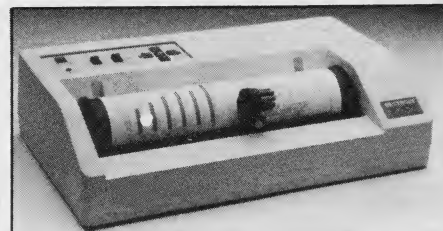
Sakata USA Corp., 651 Bonnie Ln., Elk Grove Village, IL 60007. (312) 593-3211.

CIRCLE 457 ON READER SERVICE CARD

Strobe Released Lotus 1-2-3 Interface

Strobe has released a Lotus Interface for their M260 Graphics System. The interface lets users of Lotus 1-2-3 and other spreadsheets automatically convert rows and columns to multi-colored bar charts. The M260 is an eight-pen plotter.

The Lotus interface and the M260 both sell for \$995.



Strobe Inc., 897 Independence Ave., Bldg. 5A, Mountain View, CA 94043. (415) 969-5130.

CIRCLE 458 ON READER SERVICE CARD

Graphics Tablet from Suncom

Suncom introduces the Animation Station, a touch-sensitive graphics tablet with side-mounted dual function buttons



for the IBM PC and PCjr, Commodore 64, and Apple, Franklin, and Atari computer systems.

The Animation Station carries a suggested retail price of \$115 for all models except for the Commodore 64, which retails for \$95.

Suncom, 260 Holbrook Dr., Wheeling, IL 60090. (312) 459-8000.

CIRCLE 459 ON READER SERVICE CARD

Voice Board for IBM PC

Votan has introduced the VPC 2000 Voice Card, a plug-in board that provides voice recognition, voice response, voice store and forward, and telephone management capabilities for the IBM PC. The VPC 2000 lets a user speak in conversational flow and selects and acts on target words.

The VPC 2000 Voice card, including software, microphone, and speaker, carries a suggested retail price of \$2450.

Votan, 4487 Technology Dr., Fremont, CA 94538. (415) 490-7600.

CIRCLE 460 ON READER SERVICE CARD

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Voice Recorder for IBM PC

CMC has introduced pc Dial/Log, an internal expansion board and software that connects an IBM PC or compatible

to a telephone line and records and forwards digitized voice messages. The PC Dial/Log retails for \$595.

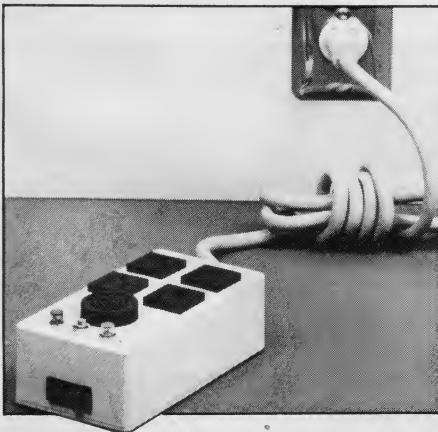
CMC International Inc., CMC International Bldg., 1720-130th Ave. NE, Bellevue, WA 98005. (206) 885-1600.

CIRCLE 461 ON READER SERVICE CARD

Miscellaneous

Protection Devices From Panamax

Ultramax, a surge and spike suppression, brown out, and noise protection device, has been introduced by Panamax. When voltage drops below a certain level, it sounds an alarm and shuts down the computer and peripherals. Ultramax retails for \$149.



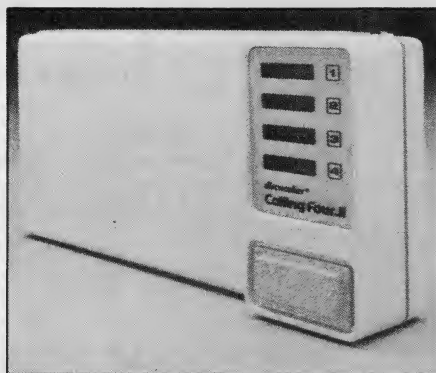
Panamax also announced the Powermax, a backup electrical power supply that protects against voltage surges, line spikes, and line noise. It provides up to 15 minutes of 200 watt battery power in the event of a power failure. Powermax sells for \$459.

Panamax, 150 Mitchell Blvd., San Rafael, CA 94903. (415) 472-5547 or (800) 472-5555.

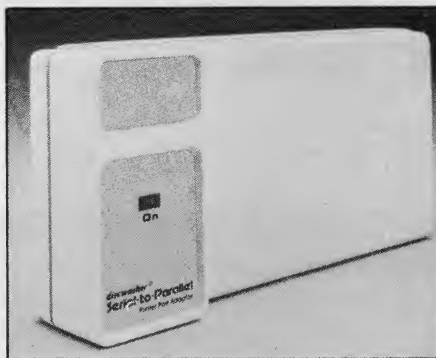
CIRCLE 462 ON READER SERVICE CARD

Port Expander and Adapter

Discwasher has introduced Calling Four II, which expands one controller port to four and allows access to a mouse and any one of three other controllers. It is compatible with Apple IIe and IIc. The suggested retail price is \$79.95.



Serial-to-Parallel, a printer port adapter from Discwasher, converts the Apple IIc serial port to a parallel port



for use with parallel printers. Serial-to-Parallel retails for \$129.95.

Discwasher, 1407 N. Providence Rd., P.O. Box 6021, Columbia, MO 65205. (314) 449-0941.

CIRCLE 463 ON READER SERVICE CARD

Single Sheet Feeder from Qume

Qume has introduced the Profeeder LP Sheetfeeder, a single bin, single sheet paper feeder for its LetterPro 20 Printer. The Profeeder carries a suggested retail price of \$465.

Qume Corp., 2350 Qume Dr., San Jose, CA 95131. (408) 942-4000.

CIRCLE 464 ON READER SERVICE CARD

Key Tronic Keyboards

Key Tronic has released new plug-compatible keyboards for the IBM PC and DEC VT-100 and a replacement keyboard for the Radio Shack TRS-80 Color Computer.

The KB-5151 keyboard for the IBM PC carries a suggested retail price of \$225. The KB-100 for the DEC VT-100 retails for \$379. The KB-500 for the Color Computer sells for \$89.95.

Key Tronic, P.O. Box 14687, Spokane, WA 99214. (509) 928-8000.

CIRCLE 465 ON READER SERVICE CARD

Starfighter Joystick

Suncom has introduced the Starfighter, an analog joystick for Apple and Franklin computers. It uses thick film resistive printing technology rather than a conventional potentiometer and mechanical linkage assembly. It includes right- and left-handed firing buttons, an alternate fire button, and centering adjustment.

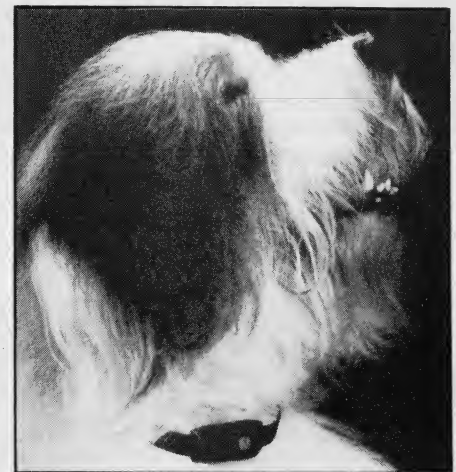
The Starfighter carries a suggested retail price of \$49.95.

Suncom, 260 Holbrook Dr., Wheeling, IL 60090. (312) 459-8000.

CIRCLE 466 ON READER SERVICE CARD

Electronic Flea Collar

Biotechnology has developed an electronic flea and tick collar that emits high-frequency, high-intensity sound to repel insects. Based on pacemaker technology, it uses a pulsed, modulated, burst circuit to create a frequency beyond the audible range of cats, dogs, and humans.



The collar, including batteries, carries a suggested retail price of \$69.95.

Biotechnology Inc., 6924 NW 46th St., Miami, FL 33166. (305) 592-6749 or (800) 327-1033.

CIRCLE 467 ON READER SERVICE CARD

Computer Com

Desktop Computers

Computer		Base Price	Micro-processor	Memory		Operating Systems	Languages	
Vendor	Model			RAM (min/max)	ROM		Standard	Options
A.B. Dick Comp. 5700 W. Touhy Ave. Chicago, IL 60648 (312) 763-1900	Knowledge Worker	\$7500	16-bit 8086, 32-bit 68000	512/1024K	NA	M-Path, CTOS, CP/M-86,MS-DOS	none	Fortran, Pascal, Basic, Cobol
Acorn Computer Corp. 400 Unicorn Park Dr. Woburn, MA 01801 (617) 935-1190	BBC micro	\$995	8-bit 6502	32/32K	16K	proprietary	Basic	Logo, Pascal
ACT International 111 Hagley Rd. Birmingham, B168LB, England (021) 454-8585	ACT Apricot	\$3100	16-bit 8086	256/768K	NA	MS-DOS, CP/M-86, concurrent CP/M-86	Basic, Personal Basic	Fortran, Pascal, Macro86, Cobol
Apple Computer Inc. 20525 Mariani Ave. Cupertino, CA 95041 (408) 996-1010	Apple IIe	\$895	8-bit 6502B	64/128K	16K	CP/M, Pro DOS	none	Pascal, Pilot, Logo, Fortran, Basic
Apple Computer Inc. 20525 Mariani Ave. Cupertino, CA 95014 (408) 996-1010	Apple III	\$2695	8-bit 6502	256/256K	4K	SOS	Applesoft Basic	Pascal, Cobol, Business Basic
Apple Computer Inc. 20525 Mariani Ave. Cupertino, CA 95014 (408) 996-1010	Macintosh	\$2495	32-bit MC68000	128/526K	64K	CP/M, MS-DOS, Zenix	none	Basic
Apple Computer Inc. 20525 Mariani Ave. Cupertino CA 95014 (408) 996-1010	Lisa 2	\$3495	32 bit MC68000	512/1024K	16K	CP/M, MS-DOS, Zenix	none	Cobol, Pascal, Basic +

Comparison Chart

Keyboard	Display		Storage	Interfaces	Notes
	Method of Display	Text Resolution			
98-key detachable full-stroke	RGB, composite	80 x 25	720 x 348	(1) 630K 5.25" drive, 10Mb hard disk	parallel, serial
74-key full-stroke	RGB, composite	80 x 25	640 x 200 (15 colors)	(1-2) 200K 5.25" drives	parallel, serial, joystick, cartridge, expansion utilities disk included
96-key detachable full-stroke	composite	80 x 24	NA	(2) 315K 3.5" drives, opt. 10Mb hard disk	parallel, serial, expansion 4 software packages bundled
63-key full-stroke	composite	40 x 24	280 x 192 (6 colors)	cassette, (0-6) 160K 5.25" drives, opt. 5Mb hard disk	joystick, expansion
74-key full-stroke	composite, TV, RGB	40 x 24	280 x 192 (16 colors)	cassette, (1-6) 140K 5.25" drives, opt. 5Mb hard disk	serial, joystick, expansion includes Apple II emulator package
58-key detachable full-stroke	composite	NA	512 x 342	(1-2) 400K 3.5" drives, opt. 10Mb hard disk	serial, expansion mouse included, MacWrite, MacPaint bundled
77-key detachable full-stroke	composite	132 x 40	720 x 364	(1-2) 400K 3.5" drives, opt. 10Mb hard disk	parallel, serial MacWorks bundled

Desktop Computers

Computer		Base Price	Micro-processor	Memory		Operating Systems	Languages	
Vendor	Model			RAM (min/max)	ROM		Standard	Options
Atari Inc. 1342 Bordeaux Dr. Sunnyvale, CA 94086 (408) 745-2810	Atari 800XL	\$399	8-bit 6502B	64/64K	24K	DOS 3	Basic	Logo, Pilot
Canon USA 1 Canon Plaza Lake Success, NY 11042 (516) 488-6700	Desktop PC	\$2495	16-bit 8086	256/512K	16K	MS-DOS 2.1	GW Basic 2.0	none
Canon USA 1 Canon Plaza Lake Success, NY 11042 (516) 488-6700	Canon AS-100	\$2495	16-bit 8088	128/512K	8K	MS-DOS, CP/M-86	none	Basic, GW Basic, Cobol
Coleco Industries, Inc. 999 Quaker Lane South West Hartford, CT 06110 (800)842-1255	Adam	\$725	8-bit Z80A	80/144K	NA	CP/M	Smart Basic	Smart Logo
Columbia Data Products, Inc. 9150 Rumsey Rd. Columbia, MD 21045 (301) 992-3400	MPC 4210	TBA	16-bit 8088	128/640K	16K	MS-DOS 2.1	BasicA 2.0	NA
Commodore Business Machines, Inc. 1200 Wilson Dr. West Chester, PA 19380 (215)431-9100	Vic 20	\$50	8-bit 6502A	5/32K	20K	none	Basic	Forth
Commodore Business Machines, Inc. 1200 Wilson Dr. West Chester, PA 19380 (215)431-9100	Commodore SX-64	\$800	8-bit 6510A	64/64K	20K	CP/M, proprietary	Basic	Logo, Pilot, Fortran, Cobol
Commodore Business Machines, Inc. 1200 Wilson Dr. West Chester, PA 19380 (715)431-9100	Commodore 64	\$219	8-bit 6510A	64/64K	20K	CP/M, proprietary	Basic	Logo, Pilot, Fortran, Cobol
Commodore Business Machines, Inc. 1200 Wilson Dr. West Chester, PA 19380 (215)431-9100	Commodore Plus/4	\$300	8-bit 7501	64/64K	32K	proprietary	Basic 3.5	Pascal, Logo
Commodore Business Machines, Inc. 1200 Wilson Dr. West Chester, PA 19380 (215)431-9100	Commodore B128	\$1000	8-bit 6509	128/128K	20K	proprietary	Basic 4.0	NA

	Keyboard	Display		Storage	Interfaces	Notes
		Method of Display	Text Resolution			
ot	62-key full-stroke	composite, TV	40 x 24	320 x 192 (256 colors)	cassette, (0-2) 130K 5.25" drives	serial, joystick, cartridge
	83-key detachable full-stroke	composite	80 x 25	640 x 200	(2-4) 360K 5.25" drives	parallel, serial, expansion
y	94-key detachable full-stroke	composite	80 x 25	640 x 400 (27colors)	(1-4) 640K 5.25" drives, opt. 10Mb hard disk	parallel, serial, expansion WordStar, CalcStar, InfoStar bundled
o	75-key detachable full-stroke	composite, TV	36 x 24	256 x 192 (16 colors)	(0-4) 160K 5.25" drives, special 128K wafertape cartridges	parallel, serial, joystick, cartridge, expansion bundled software and external 80-column printer included
	83-key detachable full-stroke	RGB, composite	80 x 25	640 x 200 (16 colors)	(2) 360K 5.25" drives, opt. 10Mb hard disk	parallel, serial, expansion 15 business packages bundled
	66-key full-stroke	composite, TV	22 x 23	176 x 184 (16 colors)	cassette, (0-4) 170K 5.25" drives	parallel, serial, joy- stick, cartridge, expansion
	66-key detachable full-stroke	composite	40 x 25	320 x 200 (16 colors)	(1-4) 170K 5.25" drives	serial, joystick, cartridge only color portable available
	66-key full-stroke	composite, TV	40 x 25	320 x 200 (16 colors)	cassette, (0-4) 170K 5.25" drives	serial, joystick, cartridge
	67-key full-stroke	composite, TV	40 x 25	320 x 200 (128 colors)	cassette, (0-5) 170K 5.25" drives	serial, joystick, car- tridge, expansion
	94-key full-stroke	composite	80 x 25	NA	(0-5) 170K 5.25" drives	serial, cartridge, expansion

Desktop Computers

Computer		Base Price	Memory			Operating Systems	Languages	
Vendor	Model		Micro-processor	RAM (min/max)	ROM		Standard	Options
Corona Data Systems, Inc. 275 E. Hillcrest Thousand Oaks, CA 91360 (800)621-6746	Corona PC-11	\$2195	16-bit 8088	128/512K	8K	MS-DOS 2.0	GW Basic	none
Corona Data Systems, Inc. 275 E. Hillcrest Thousand Oaks, CA 91360 (800)621-6746	Corona Personal Best Model PB400	\$5095	16-bit 8088	512/512K	16K	MS-DOS, concurrent CP/M	GW Basic 1.0	none
Corvus Systems 2100 Corvus Dr. San Jose, CA 95124 (408)559-7000	Corvus Concept	\$4295	16-bit 68000	256/512K	NA	proprietary	Pascal	Basic, Fortran, C
Cromenco Inc. 280 Bernardo Ave Mountain View, CA 94039 (415) 964-7400	Cromenco C-10	\$1785	8-bit Z80A	64/64K	24K	CP/M-80, CDOS	Basic	Cobol, Fortran, Lisp
Eagle Computer 983 University Ave. Los Gatos, CA 95030 (402) 399-4200	Eagle PC Turbo XL	\$4995	16-bit 8086	256/512K	NA	MS-DOS	Basic A	Pascal, Fortran, C, Cobol, Logo
Eagle Computer 983 University Ave. Los Gatos, CA 95030 (408) 399-4200	Eagle PC Plus 1	\$1795	16-bit 8088	128/640K	NA	MS-DOS	Basic A	Pascal, Fortran, C, Cobol, Logo
Epson America, Inc. 3415 Kashiwa St. Torrance, CA 90505 (213) 539-9140	Epson QX-10	\$2495	8-bit Z80A	256/256K	8K	Valdocs, TP/M II, MS-DOS, CP/M-80B	Basic	Cobol, Pascal, Forth
Fujitsu Microelectronics, Inc. 3055 Orchard Dr. San Jose, CA 95134 (408) 946-8777	Fujitsu Micro 16s	\$3995	8-bit Z80A, 16-bit 8086	128/1000K	NA	CP/M-86, MS-DOS	none	NA
Hewlett Packard 19420 Homestead Rd. Cupertino, CA 95014 (408) 725-8111	HP-150	\$3495	16-bit 8088	256/640K	160K	MS-DOS 2.0	Basic, Pascal, Fortran, Cobol	NA
International Business Machines PO Box 1328 Boca Raton, FL 33432 (305) 998-2000	IBM PCjr	\$599	16-bit 8088	64/512K	64K	MS-DOS	Basic	Pascal, C, Fortran

Keyboard	Display			Storage	Interfaces	Notes
	Method of Display	Text Resolution	Graphics Resolution			
83-key detachable full-stroke	composite	80 x 25	640 x 325	(1-2) 320K 5.25" drives, opt. 10Mb hard disk	parallel, serial	MultiMate, PC Tutor bundled
83-key detachable full-stroke	composite	80 x 25	640 x 400	(2-4) 360K 5.25" drives, 10Mb hard disk	parallel, serial, expansion	MultiMate, PC Tutor bundled
89-key detachable full-stroke	composite	120 x 56	720 x 560	(0-4) 720K 5.25" drives, opt. 45Mb hard disk	serial, expansion	EdWord bundled
60-key detachable full-stroke	composite	80 x 25	160 x 72	(1-2) 390K 5.25" drives, opt. 50Mb hard disk	parallel, serial	WriteMaster, CalcMaster, MoneyMaster, ScreenEditor bundled
84-key detachable full-stroke	composite	80 x 25	640 x 200	(1) 360K 5.25" drive, 10Mb hard disk	parallel, expansion	
84-key detachable full-stroke	composite	80 x 25	640 x 200	(1-2) 360K 5.25" drives, opt. 10Mb hard disk	parallel, serial, expansion	
104-key detachable full-stroke	composite	80 x 25	640 x 400	(2) 380K 5.25" drives, opt. 10Mb hard disk	parallel, serial, expansion	
98-key detachable full-stroke	composite	80 x 25	640 x 200 (8 colors)	(2) 320K 5.25" drives, opt. 20Mb hard disk	parallel, serial, expansion	WordStar, SuperCalac bundled
107-key detachable full-stroke	composite	80 x 24	512 x 390	(2) 270K 3.5" drives, opt. 15Mb hard disk	serial	"touch screen" technology, Lotus 1-2-3, MemoMaker, Personal Card File bundled
62-key detachable full-stroke	RGB, composite, TV	80 x 25	640 x 200 (16 colors)	cassette, (0-4) 360K 5.25" drives	serial, joystick, cartridge, expansion	wireless infrared keyboard link

Desktop Computers

Computer		Base Price	Micro-processor	Memory		Operating Systems	Languages	
Vendor	Model			RAM (min/max)	ROM		Standard	Options
International Business Machines P.O. Box 1328 Boca Raton, FL 33432 (305) 998-2000	IBM Personal Computer	\$1265	16-bit 8088	256/640K	48K	MS-DOS, CP/M-86, UCSD p-System, Xenix	Basic	Pascal, C, Fortran, Cobol, APL, Lisp
Intertec 2300 Broad River Rd. Columbia, SC 29210 (803) 798-9100	Compustar II VPU Model 20	\$2495	8-bit Z80	64/64K	NA	CP/M 2.2 +	Basic	Fortran, C, Pascal, Cobol
Intertec 2300 Broad River Rd. Columbia, SC 29210 (803) 798-9100	HeadStart VPU Model 512	\$3495	16-bit 8086, 8-bit Z80A	512/1000K	NA	MS-DOS, LANDOS, CP/M-80	MBasic 80	Fortran, Cobol, Pascal, C
ITT Information Systems PO Box 52016 Phoenix, AZ 85072 (602) 894-7000	XTRA Personal Computer	\$1895	16-bit 8088	128/640K	32K	ITT DOS	XBasic	Pascal, Fortran, Cobol, C
Leading Edge 21 Highland Circle Needham Heights, MA 02194 (617) 828-8150	Leading Edge PC	\$2500	16-bit 8088	128/640K	64K	MS-DOS 1.25	Basic	Fortran, Cobol
Magic Computer Company, Inc. 333 Rt. 46 West Fairfield, NJ 07024 (201) 227-8833	Magic Computer	\$1795	8-bit Z80A, 8-bit 6502	64/64K	8K	CP/M 2.21	CBasic	Cobol, Fortran, PL-1
Materials Development Corp. 21541 Nordhott St. Chatsworth, CA 91311 (818) 700-8290	RM-1600	\$3995	16-bit 8088	256/512K	NA	MS-DOS	Basic	Fortran, Pascal
Memotech Corp. 99 Cabot St. Needham, MA 02194 (617) 449-6614	Memotech MTX-512	\$595	8-bit Z80	64/512K	72K	CP/M	Basic	Forth, Pascal
Micro Craft Corp. 4747 Irving Blvd. Dallas, TX 75247 (214) 630-2562	Dimension	\$3995	32-bit MC68000	256/4000K	8K	CP/68K, Idris, Unix, p-System, Mirage	UniBasic, C	Fortran, Pascal, Forth, Cobol, APL
Monroe Systems For Business The American Road Morris Plains, NJ 07950 (201) 993-2000	System 2000	\$3695	16-bit 80186	128/896K	8K	CP/M-86, DPX, MS-DOS, MP/M-86	GW Basic	Pascal, Fortran, Cobol, C

Keyboard	Display			Storage	Interfaces	Notes
	Method of Display	Text Resolution	Graphics Resolution			
83-key detachable full-stroke	RGB, composite, TV	80 x 25	320 x 200 (16 colors)	cassette, (0-2) 360K 5.25" drives, opt. 20Mb hard disk	expansion	
79-key full-stroke	composite	80 x 24	NA	(2) 350K 5.25" drives, opt. 140Mb hard disk	parallel, serial	
105-key detachable full-stroke	composite	132 x 25	NA	(1-3) 500K 3.5" drives, opt. 50Mb hard disk	parallel, serial, expansion	
84-key detachable full-stroke	RGB, composite	80 x 25	320 x 200 (16 colors)	(1-2) 360K 5.25" drives, opt. 10Mb hard disk	parallel, serial, expansion	
83-key detachable full-stroke	composite	80 x 25	NA	(2-4) 360K 5.25" drives, opt. 20Mb hard disk	parallel, serial, expansion	word processor bundled
73-key detachable full-stroke	composite	80 x 24	640 x 200 (16 colors)	(1-2) 400K 5.25" drives, opt. 20Mb hard disk	parallel series	Perfect software series bundled
83-key detachable full-stroke	composite	80 x 25	640 x 325 (16 colors)	(1-2) 360K 5.25" drives, opt. 10Mb hard disk	parallel, serial, expansion	19" rack-mountable chassis
79-key detachable full-stroke	composite	80 x 24	256 x 192 (16 colors)	cassette, (1-2) 320K 5.25" drives, opt. 20Mb hard disk	parallel, serial, joystick, cartridge	
83-key detachable full-stroke	RGB, composite	100 x 50	640 x 480 (4 colors)	(2-4) 400K 5.25" drives, opt. 150Mb hard disk	parallel, serial, joystick, expansion	
92-key detachable full-stroke	RGB, composite	80 x 25	640 x 400 (16 colors)	(2) 720K 5.25" drives, opt. 20Mb hard disk	parallel, serial, expansion	

Desktop Computers

Computer		Base Price	Micro-processor	Memory		Operating Systems	Languages	
Vendor	Model			RAM (min/max)	ROM		Standard	Options
Morrow Designs 600 McCormick St. San Leandro, CA 94577 (415) 430-1970	Micro Design MDle	\$995	8-bit Z80A	64/64K	2K	CP/M	Pilot, BaZic, Basic 80	none
Morrow Designs 600 McCormick St. San Leandro, CA 94577 (415) 430-1970	MD2	\$1699	8-bit Z80A	64/64K	2K	CP/M, MS-DOS	Pilot, BaZic, Basic 80	none
Morrow Designs 600 McCormick St. San Leandro, CA 94577 (415) 430-1970	MD 11	\$2995	8-bit Z80A	128/128K	2K	CP/M, MS-DOS	Pilot, BaZic, Basic 80	none
NBI PO Box 9001 Boulder, CO 80301 (800) NBI-8111	OASys 4100S	\$2725	16-bit 8088	320/640K	36K	MS-DOS	Basic	Fortran Pascal Cobol
NCR Corp. 1700 S. Patterson Blvd. Dayton, OH 45479 (513) 445-2077	Decision Mate V	\$2650	8-bit Z80A	64/512K	4K	CP/M, CP/M-86, MS-DOS	GW Basic	C Basic. Cobol. Pascal, Fortran
NEC Information Systems 5 Militia Dr. Lexington, MA 02173 (617) 862-3120	PC-6000 NEC Trek	\$349.95	8-bit 780C-1	16/32K	32K	proprietary	Basic	none
NEC Information Systems 5 Militia Dr. Lexington, MA 02173 (617) 862-3120	NEC PC-8800	\$2497	8-bit Z80A	64/512K	72K	CP/M, MS-DOS	Basic	NA
NEC Information Systems 5 Militia Dr. Lexington, MA 02173 (617) 862-3120	APC	\$2748	16-bit 8086	128/640K	4K	CP/M-86, MS-DOS, UCSD p-system,	none	Basic, Fortran, Pascal, Cobol
Olivetti Corp. 155 White Plains Rd. Tarrytown, NY 10591 (914) 631-7907	Olivetti M20	\$2965	16-bit Z8001	128/512K	NA	CP/M	Basic 8000	NA
Pertec Computer Corp. 17112 Armstrong Ave. Irvine, CA 92713 (714) 660-0488	3215 Desktop System	\$6900	32-bit 68000	356/1000K	16K	OS 3200, Unix, Pick	none	RM/Cobol, Basic, C, Pascal, Fortran

Keyboard	Display			Storage	Interfaces	Notes
	Method of Display	Text Resolution	Graphics Resolution			
92-key full-stroke	composite	80 x 24	NA	(1-2) 384K 5.25" drives	parallel, serial	word processor bundled
92-key detachable full-stroke	composite	80 x 24	none	(1-4) 384K 5.25" drives	parallel, serial	WordStar, Correct-It, Logic Calc, Personal Pearl bundled
92-key detachable full-stroke	composite	80 x 24	NA	(2-4) 384K 5.25" drives, opt. 34Mb hard disk	parallel, serial	WordStar, Logic Calc, Personal Pascal, Correct-it bundled
57-key detachable full-stroke	composite RGB	80 x 25	640 x 200	(1-2) 5.25" drives, opt. 10Mb hard disk	parallel, serial, expansion	4100X includes 10Mb hard disk drive
100-key detachable full-stroke	RGB, composite	80 x 25 (8 colors)	640 x 400	(2) 320K 5.25" drives, opt. 10Mb hard disk	expansion	
71-key full-stroke	RGB, composite,	32 x 16	64 x 48 (9 colors)	cassette, (0-1) 160K 5.25" drives	parallel, joystick	
92-key detachable full-stroke	RGB, composite	80 x 25	640 x 200 (8 colors)	cassette, (0-4) 1Mb 8" drives, opt. 10Mb hard disk	parallel, serial, expansion	WordStar, MailMerge, MultiPlan bundled
108-key detachable full-stroke	composite	80 x 25	640 x 475 (8 colors)	(1-2) 2Mb 8" drives, opt. 20Mb hard disk	parallel, serial	
72-key full-stroke	composite	80 x 24	512 x 256 (8 colors)	(1-2) 320K 5.25" drives, opt. 10Mb hard disk	parallel, serial	Oliword, Olientry, Sort Master bundled
97-key detachable full-stroke	composite	80 x 25	NA	(1-4) 1Mb 5.25" drives, opt. 53Mb hard disk	serial, expansion	

Desktop Computers

Computer		Base Price	Micro-processor	Memory		Operating Systems	Languages	
Vendor	Model			RAM (min/max)	ROM		Standard	Options
Quasar Data Products 10330 Brecksville Rd. Cleveland, OH 44141 (216) 526-0838	QDP-400	\$8295	280BK	128/768K	16K	CP/M-86, CP/M, MP/M	TurboDos, Cobol, Fortran, C	Basic,
Quasar Data Products 10330 Brecksville Rd. Cleveland, OH 44141 (216) 526-0838	QDP-500	\$1995	Z80A	128/768K	16K	CP/M, MP/M		Basic, Cobol, Fortran, C
Sanyo Business Systems Corp. 51 Joseph St. Moonachie, NJ 07074 (201) 440-9300	MBC 550	\$999	16-bit 8088	128/256K	40K	MS-DOS	Basic	Fortran
Sanyo Business Systems Corp. 51 Joseph St. Moonachie, NJ 07074 (201) 440-9300	MBC 1100	\$1699	8-bit Z80A	64/64K	12K	CP/M	Basic	Pascal, Cobol, Fortran, Basic-80
Sanyo Business Systems Corp. 51 Joseph St. Moonachie, NJ 07074 (201) 440-9300	MBC 1200	\$1995	8-bit Z80A	64/64K	12K	CP/M	Basic	Pascal, Cobol, Fortran, Basic-80
Seiko/SMC Intech 1305 W. Belt Rd. Suite 319 Carrollton, TX 75006 (800) 368-5010	Series 8600	\$3965	16-bit 8086	128/512K	16K	CP/M-86, MP-M-86, MS-DOS, Oasis-86	none	Basic, Fortran, Cobol, Pascal, C
Sony Corporation of America 1 Sony Drive Park Ridge, NJ 07656 (201) 930-1000	Sony SMC-70	\$995	80-bit Z80A	64/832K	32K	CP/M, CP/M-86, concurrent CP/M	Basic	CB-80, Fortran, Pascal, Cobol
Sord Computer of America Basic, C, 645 5th Ave. New York, NY 10022	M68	\$4490	16-bit MC68000, 8-bit Z80A	206/4000K	4K	CP/M-86, p-System, KDOS, CP/M-80	none	Pascal, RDOS, UCSD Fortran, APL
Sperry Corp. PO Box 500 Blue Bell, PA 19424 (215) 542-4213	Personal Computer	\$2643	16-bit 8088	128/640K	40K	MS-DOS	GW Basic	Pascal, Fortran, Cobol, C
Stearns Computer Systems 10901 Bren Road East Minneapolis, MN 55440 (612) 936-2000	Desktop Computer	\$2995	16-bit 8086	128/896K	16K	STDOS, MS-DOS, MP/M-86	Basic	Fortran, Cobol, Pascal

Keyboard	Display		Storage	Interfaces	Notes
	Method of Display	Text Resolution			
Extra	terminal or graphics terminal	NA	NA	(1) 1.2Mb 8" drive, (1) 55Mb hard disk	parallel, serial, expansion word processor, spreadsheet, data base software bundled
Extra	terminal or graphics terminal	NA	NA	(1) 1.2Mb 5.25" drives, opt. 10Mb hard disk	parallel port, serial port, expansion slot
85-key detachable full-stroke	composite	80 x 25	640 x 200 (8 colors)	(1-2) 320K 5.25" drives, opt. 10Mb hard disk	parallel, serial WordStar, CalcStar, EasyWriter bundled
100-key detachable full-stroke	composite	80 x 25	NA	(1-2) 320K 5.25" drives, opt. 10Mb hard disk	parallel, serial WordStar, InfoStar, Calc Star, SpellStar, MailMerge bundled
100-key detachable full-stroke	composite	80 x 40	640 x 400 (8 colors)	(1-2) 640K 5.25" drives	parallel, serial WordStar, CalcStar, MailMerge, InfoStar, SpellStar bundled
100-key detachable full-stroke	composite	80 x 24	NA	(1-2) 640K 5.25" drives, opt. 20Mb hard disk	parallel, serial 4 software packages bundled
72-key full-stroke	RGB, composite	80 x 25	320 x 200 (16 colors)	cassette, (1-2) 280K 3.5" drives, opt. 20Mb hard disk	parallel, serial, joystick, expansion
92-key detachable full-stroke	composite	80 x 25	640 x 400 (16 colors)	(0-2) 1.2Mb 5.25" drives, opt. 15Mb hard disk	parallel, serial
83-key detachable full-stroke	RGB, composite	80 x 25	640 x 400 (256 colors)	(1-2) 360K 5.25" drives, opt. 10Mb hard disk	parallel, serial, expansion
94-key detachable full-stroke	RGB, composite	80 x 26	640 x 208 (8 colors)	(1-4) 320K 5.25" drive, opt. 20Mb hard disk	parallel, serial, expansion

Desktop Computers

Computer		Base Price	Micro-processor	Memory		Operating Systems	Languages	
Vendor	Model			RAM (min/max)	ROM		Standard	Options
Sulcus Computer Corp. 41 North Main St. Greensburg, PA 15601 (412) 836-2000	Model 6000	\$5350	8-bit Z80	64/1000K	16K	CP/M, MS-DOS, CP/M-86	MBasic, CBasic, CB80	Fortran, Pascal, Cobol
Tandy-Radio Shack 1500 1 Tandy Center Fort Worth, TX 76102 (817) 338-2394	TRS-80 Color Computer 2	\$159.95	8-bit 6809E	16/64K	8K	OS-9, Flex, proprietary	Basic	Logo, Pilot, Basic-09
Tandy-Radio Shack 1500 1 Tandy Center Fort Worth, TX 76107 (817) 332-2394	TRS-80 Model 4	\$999	8-bit Z80A	16/64K	14K	TRSDOS	Basic	CBasic, Cobol, Fortran, Pascal MT+
Tandy-Radio Shack 1500 1 Tandy Center Fort Worth, TX 76102 (817) 338-2394	TRS-80 Model 12	\$2799	8-bit Z80A	80/256K	NA	CP/M Plus	Basic	Fortran, Cobol, Pascal MT+, CBasic
Tandy-Radio Shack 1500 1 Tandy Center Fort Worth, TX 76102 (817) 338-2394	TRS-80 Model 16B	\$3999	32-bit MC68000, 8-bit Z80A	256/768K	18K	TRS-Xenix, CP/M Plus	none	CBasic, Fortran, Pascal MT+, Cobol
Tandy-Radio Shack 1500 1 Tandy Center Fort Worth, TX 76102 (817) 338-2394	Tandy TRS-80 Model 2000	\$2750	16-bit 80186	128/768K	NA	MS-DOS 2.0	GW Basic	Pascal, Fortran, Cobol
Texas Instruments Dept. 1-A PO 402430 Dallas, TX 75240 (800) 527-3500	TI Professional Computer	\$2195	16-bit 8088	64/256K	16K	MS-DOS, CP/M-86, UCSD p-System	Basic	Fortran, Cobol, Pascal
Timex Computer Park Road Extension Waterbury, CT 06720 (203) 574-3331	Timex Sinclair 2068	\$99	8-bit Z80A	48/48K	24K	proprietary	Basic	none
Toshiba America Inc. 2441 Michelle Dr. Tustin, CA 92680 (714) 730-8000	Toshiba T300	\$2295	16-bit	192/512K	4K	CP/M-86, MS-DOS	TBasic 16	Pascal, Cobol, Fortran, CBasic-86
Video Technology 2633 Greenleaf Ave. Elk Grove Village, IL 60007 (312) 640-1776	Laser 200	\$100	8-bit Z80A	4/64K	16K	proprietary	Basic	none

Keyboard	Display		Storage	Interfaces	Notes
	Method of Display	Text Resolution			
96-key detachable full-stroke	RGB, composite	80 x 25	NA	(2-4) 400K 5.25" drives, opt. 40Mb hard disk	parallel, serial, joystick, cartridge printer included
53-key full stroke	TV	32 x 16	256 x 192 (8 colors)	cassette, (0-4) 156K 5.25" drives	serial, joystick, cartridge mouse available
70-key full-stroke	composite	64 x 16	128 x 48	cassette, (0-4) 184K 5.25" drives, opt. 5Mb hard disk	parallel
82-key detachable full-stroke	composite	80 x 24	NA	(1-4) 1.25Mb 8" drives, opt. 12Mb hard disk	parallel, serial, expansion
82-key detachable full-stroke	composite	80 x 24	NA	(1-4) 1.25 Mb 8" drives, opt. 15Mb hard disk	parallel, serial
90-key detachable full-stroke	RGB, composite	80 x 25	NA	(2) 720K 5.25" drives, opt. 10Mb hard disk	parallel, serial, expansion
97-key, detachable full-stroke	RGB, composite	80 x 25	720 x 300 (16 colors)	(1-4) 320K 5.25" drives, opt. 10Mb hard disk	parallel, serial, joystick, expansion
42-key chiclet	composite, TV	64 x 24	512 x 192 (8 colors)	cassette, (0-8) 85K microdrives	joystick, cartridge, expansion
103-key full-stroke	RGB, composite	80 x 25	640 x 500 (16 colors)	(1-2) 640K 5.25" drives, opt. 10Mb hard disk	parallel, serial 7 software packages bundled
45-key chiclet	composite, TV	32 x 16	128 x 64 (9 colors)	cassette, (0-2) 116K 5.25" drives	parallel, expansion

Desktop Computers / Portable Computers

Computer		Base Price	Micro-processor	Memory		Operating Systems	Languages	
Vendor	Model			RAM (min/max)	ROM		Standard	Options
Video Technology 2633 Greenleaf Ave. Elk Grove Village, IL 60007 (312) 640-1776	Laser 3000	\$695	8-bit 6502, opt. 8-bit Z80	64/192K	32K	CP/M	Basic	Pascal, Fortran
Wang Laboratories, Inc. 1 Industrial Ave. Lowell, MA 01851 (617) 459-5000	Wang Professional Computer	\$2445	16-bit 8086	256/768K	16K	MS-DOS, p-System, CP/M-80	GW Basic	Fortran, Pascal, Cobol
Xerox Corp. 1341 W. Mockingbird Lane Dallas, TX 75247 (214) 689-6000	Xerox 16/8	\$1950	16-bit 8086, 8-bit Z80	64/256K	32K	CP/M, MS-DOS	none	Basic-80, Fortran, Pascal
Zenith Data Systems 1000 Milwaukee Ave. Glenview, IL 60025 (312) 391-8860	Z-150	\$2199	16-bit 8088	128/640K	NA	MS-DOS	none	Basic, Cobol, Fortran, Pascal
Zenith Data Systems 1000 Milwaukee Ave. Glenview, IL 60025 (312) 391-8860	Z-100 Low Profile	\$3029	16-bit 8088/ 8-bit 8085	128/768K	NA	MS-DOS	none	Basic, Cobol, Fortran, Pascal

Portable Computers

Actrix Computer Corp. 2159 Bering Dr. San Jose, CA 95131 (408) 263-3660	Actrix	\$2190	8-bit Z80A	64/256K	4K	CP/M, MS-DOS	MBasic, CBasic	none
Apple Computer Inc. 20525 Mariani Ave. Cupertino, CA 95014 (408) 996-1010	Apple IIc	\$1295	8-bit 65C02	128/128K	16K	ProDOS	Basic	Logo
Columbia Data Products, Inc. 9150 Runsey Rd. Columbia, MD 21045 (301) 992-3400	VP 2110	TBA	16-bit 8088	128/640K	12K	MS-DOS 2.1	BasicA 2.0	none
Compaq Computer Corp. 12330 Perry Rd. Houston, TX 77070 (713) 370-7040	Compaq	\$2995	16-bit 8088	128/256K	NA	MS-DOS	Basic	Pascal, Cobol, C, Fortran

Keyboard	Display			Storage	Interfaces	Notes
	Method of Display	Text Resolution	Graphics Resolution			
81-key full-stroke	RGB, composite, TV	80 x 24	560 x 192 (8 colors)	cassette, (0-2) 160K 5.25" drives	parallel, serial, joystick, cartridge	
101-key detachable full-stroke	RGB, composite	80 x 25	640 x 250 (16 colors)	(1-2) 360K 5.25" drives, opt. 30Mb hard disk	parallel, serial, expansion	PC Tutor bundled
96-key full-stroke	composite	80 x 24	NA	(1-2) 360K 5.25" drive, opt. 10Mb hard disk	parallel, serial, expansion	
57-key, detachable full-stroke	RGB, composite	80 x 25	320 x 200 (4 colors)	(1-2) 360K 5.25" drives, opt. 10Mb hard disk	parallel, serial, expansion	
77-key full stroke	composite	80 x 25	640 x 225	(1-2) 640K 5.25" drives, opt. 10Mb hard disk	parallel, serial, expansion	
75-key detachable full-stroke	composite, TV	80 x 25	none	(2) 180K 5.25" drives, opt. 10Mb hard disk	parallel, serial	built-in printer, direct-connect modem, 80-column perfect-series bundled
63-key full-stroke	RGB, composite, TV, LCD	80 x 24	560 x 192 (16 colors)	(1-2) 143K 5.25" drives, opt. 10Mb hard disk	serial, joystick	selectable Dvorak keyboard mode
83-key detachable full-stroke	composite	80 x 25	640 x 200	(1-2) 360K 5.25" drives	parallel, serial, expansion	15 business packages bundled
83-key detachable full-stroke	RGB, composite, TV	80 x 25	NA	(1-2) 320K 5.25" drives	parallel, serial, expansion	

Portable Computers

Computer		Base Price	Memory			Operating Systems	Languages	
Vendor	Model		Micro-processor	RAM (min/max)	ROM		Standard	Options
Compaq Computer Corp. 12330 Perry Rd. Houston, TX 77070 (713) 370-7040	Compaq Plus	TBA	16-bit 8088	128/640K	NA	MS-DOS	Basic	Pascal, Cobol, C, Fortran
Comp-u-save PO Box 1300 Skyland, NC 28776 (704) 274-3003	Alex 500A	\$1495	8-bit 6502	64/128K	4K	Apple DOS	Basic	Pascal, Fortran, Pilot, Logo
Corona Data Systems, Inc. 275 E. Hillcrest Thousand Oaks, CA 91360 (800) 621-6746	PPC-11	\$2195	16-bit 8088	128/512K	8K	MS-DOS 2.0	NA	NA
Dynalogic-InfoTech Corp. 141 Bently Ave. Ottawa, Canada K2E 6T7 (613) 727-1900	Hyperion	\$3690	16-bit 8088, 8087	256/640K	8K	MS-DOS	Basic	Cobol, Fortran, Pascal
Eagle Computer Corp. 983 University Ave Los Gatos, CA 95030 (408) 399-4200	Eagle PC Spirit Two	\$2695	16-bit 8088	128/640K	NA	MS-DOS	BasicA	Pascal, Fortran, C, Cobol, Logo
Gavilan Computer Corp. 240 Hacienda Ave. Campbell, CA 95008 (408) 379-8000	Gavilan SC	\$2995	16-bit 8088	64/192K	48K	MS-DOS	MBasic	NA
Hewlett Packard 19420 Homestead Rd. Cupertino, CA 95014 (408) 725-8111	HP-75D	\$1095	8-bit custom CMOS	16/24K	48K	proprietary	Basic	none
International Business Machines PO Box 1328 Boca Raton, FL 33432 (305) 998-2000	IBM Portable PC	\$2595	16-bit 8088	256/512K	40K	MS-DOS	Basic	Pascal, C, Fortran, Cobol, APL, Lisp
Otrona 4725 Walnut St. Boulder, CO 80301 (303) 444-8100	Otrona Z001	\$2495	16-bit 8088	128/640K	NA	CP/M, MS-DOS	none	GW Basic, Pascal, Fortran
Panasonic Industrial Co. 1 Panasonic Way Secaucus, NJ 07094 (201) 348-5200	Senior Partner	\$2495	16-bit 8088	128/512K	16K	MS-DOS	none	GW Basic

Keyboard	Display		Storage	Interfaces	Notes	
	Method of Display	Text Resolution				Graphics Resolution
83-key detachable full-stroke	RGB composite, TV	80 x 25	NA	(1) 360K 5.25" drive, 10Mb hard disk	parallel, expansion	
63-key detachable full-stroke	composite	40 x 24	280 x 192 (6 colors)	(2) 160K 5.25" drives	parallel, serial, joystick, expansion	
83-key detachable full-stroke	composite	80 x 25	640 x 325	(1-2) 320K 5.25" drives, opt. 10Mb hard disk	parallel, serial	Multi-Mate, PC Tutor bundled
84-key detachable full-stroke	composite, TV	80 x 25	640 x 250	(2) 320K 5.25" drives, opt. 10Mb hard disk	expansion	built-in 300 baud modem, Multiplan, word processor, EMail bundled
84-key detachable full-stroke	RGB, composite	80 x 25	640 x 200 (16 colors)	(2) 360K 5.25" drives, opt. 10Mb hard disk	parallel, serial, expansion	
69-key full-stroke	composite	80 x 8	400 x 64	(1-2) 320K 3.5" drives	parallel, serial	built-in 300 baud modem, touch-pad LCD below monitor
67-key chiclet	LCD, composite and TV with adapter	32 x 1	none	cassette, 1.4K 10" magnetic cards	serial, cartridge	
83-key detachable full-stroke	composite	80 x 25	320 x 200	(1-2) 360K 5.25" drives	parallel, serial, joystick, expansion	
84-key detachable full-stroke	composite	80 x 25	640 x 200 (8 colors)	(1-2) 360K 5.25" drives, opt. 10Mb hard disk	parallel, serial	
83-key detachable full-stroke	RGB, composite	80 x 25	640 x 200 (16 colors)	(1-2) 360K 5.25" drives, opt. 10Mb hard disk	parallel, serial	

Portable Computers / Notebook Computers

Computer	Memory	Operating Systems	Languages	Vendor	Model	Base Price	Micro-processor	RAM (min/max)	ROM	Standard	Options
				Sord Computer of America 645 5th Ave. New York, NY 10022 (212) 759-0140	M23P	\$1995	8-bit 280A	128/128K	4K	CP/M-80, UCSD p-System	Basic
Tandy-Radio Shack 1500 1 Tandy Center Fort Worth, TX 76107 (817) 338-2394	TRS-80 Model 4P	\$1799	8-bit Z80A	64/128K	NA	TRS DOS, CP/M Plus	Basic	Pascal MT+, Fortran, Cobol, CBasic			
Visual Computer 135 Maple St. Marlboro, MA 01757 (617) 480-0000	Commuter Computer	\$1995	16-bit 8088	128/512K	16K	MS-DOS 2.11	GW Basic	Pascal, Fortran, Logo, Cobol, C, Lisp			
Zenith Data Systems 1000 Milwaukee Ave Glenview, IL 60025 (312) 391-8860	Z-160	\$2399	16-bit 8088	128/640K	NA	MS-DOS	none	Basic Cobol, Fortran, Pascal			

Notebook Computers

Convergent Technologies 2441 Mission College Blvd. Santa Clara, CA 95050 (408) 727-8830	WorkSlate	\$1195	8-bit 6800	16/16K	64K	proprietary	none	NA
Epson America, Inc. 3415 Kashiwa St. Torrance, CA 90505 (213) 539-9140	Epson HX-20	\$795	8-bit 6301	16/32K	32K	proprietary	Basic	none
Hewlett Packard 19420 Homestead Rd. Cupertino, CA 95014 (408) 725-8111	HP 110	\$2995	16-bit 8086	272/272K	384K	MS-DOS 2.11	none	Basic, Pascal, Fortran, Logo, Lisp
MicroOffice Systems Technology, Inc. 35 Kings Highway E. Fairfield, CT 06430 (203) 367-2525	Road Runner	\$1775	8-bit Z80	48/48K	16K	CP/M	none	Basic
NEC Information Systems 5 Militia Dr. Lexington, MA 02173 (617) 862-3120	NEC PC-8201	\$799	8-bit 80C85	16/64K	64K	CP/M	Basic	none

Keyboard	Display		Storage	Interfaces	Notes	
	Method of Display	Text Resolution				Graphics Resolution
92-key full-stroke	composite	80 x 25	640 x 256 (8 colors)	(1-2) 290K 3.5" drives	parallel, serial, expansion	4 software package bundled
70-key detachable full-stroke	composite	80 x 24	128 x 48	(2) 184K 5.25" drives	parallel, serial	
83-key full-stroke	RGB, composite, opt. LCD	80 x 25	640 x 200 (16 colors)	(1-2) 360K 5.25" drives, opt. 10Mb hard disk	parallel, serial	
57-key detachable full-stroke	RGB, composite	80 x 25	320 x 200 (4 colors)	(1-2) 360K 5.25" drives	parallel, serial	
60-key chiclet	LCD	46 x 16	none	microcassette		300 baud modem built-in
68-key full-stroke	LCD	20 x 4	120 x 32	microcassette	serial	Skiwriter bundled, 24-column printer built-in
75-key half-stroke	LCD	80 x 16	128 x 140	(0-2) 630K 3.5" drive	parallel, serial	Lotus 1-2-3, MemoMaker, Personal Applications Manager bundled
73-key full-stroke	LCD	80 x 8	480 x 64	cassette	serial, cartridge, expansion	
67-key full-stroke	LCD	40 x 8	240 x 64	cassette, (0-2) 5.25" drives,	parallel, serial, cartridge	software bundled

Notebook Computers / Pocket Computers

Computer		Memory		Operating Systems	Languages		
Vendor	Model	Base Price	Micro-processor	RAM (min/max)	ROM	Standard	Options
Sharp Electronics Corp. 10 Sharp Plaza Paramus, NJ 07652 (201) 256-6500	Sharp PC-5000	\$1995	16-bit 8088	128/256K	64K	MS-DOS	GW Basic none
Sord Computer of America 645 5th Ave. New York, NY 10022 (212) 759-0140	IS-11 Consultant	\$995	8-bit Z80A	32/64K	64K	MS-DOS, CP/M	none Basic
Tandy-Radio Shack 1500 Tandy Dr. Fort Worth, TX 76102 (617) 338-2394	TRS-80 Model 100	\$799	8-bit 80C85	8/32K	32K	proprietary	Basic none
Teleram Communications Corp. 2 Corporate Park Dr. White Plains, NY 10604 (914) 694-9270	Teleram T-3000	\$1795	8-bit Z80	64/256K	4K	CP/M	MBasic NA
Texas Instruments Dept. 1-A PO 402430 Dallas, TX 75240 (800) 527-3500	TI CC-40	\$250	8-bit 70C20	6/16K	34K	proprietary	Basic none

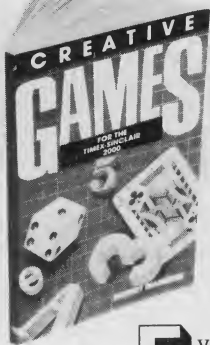
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Casio, Inc. 15 Gardner Rd. Fairfield, NJ 07006 (201) 575-7400	Casio PB-700	\$199.95	custom	4/16K	25K	proprietary	Basic none
Casio, Inc. 15 Gardner Rd. Fairfield, NJ 07006 (201) 575-7400	Casio FX-720P	\$79.95	custom	2/4K	NA	proprietary	Basic none
Casio, Inc. 15 Gardner Rd. Fairfield, NJ 07006 (201) 575-7400	Casio FX-750P	\$129.95	custom	4/8K	NA	proprietary	Basic none
Casio, Inc. 15 Gardner Rd. Fairfield, NJ 07006 (201) 575-7400	Casio FX-802P	\$149.95	custom	2/2K	NA	proprietary	Basic none

Keyboard	Display		Storage	Interfaces	Notes
	Method of Display	Text Resolution			
57-key full-stroke	LCD	80 x 8	640 x 80	cassette, (0-1) 320K 5.25" drives	serial, cartridge, expansion SuperWriter, SuperComm bundled
62-key full-stroke	LCD	40 x 8	256 x 64	cassette, (0-1) 290K 3.5" drives	parallel, serial, cartridge word processor, telecommunications, spreadsheet, database bundled
56-key full-stroke	LCD	40 x 8	240 x 64	cassette, (0-2) 186K 5.25" drives	parallel, serial built-in 300 baud modem, several utility packages in ROM
83-key full-stroke	LCD	80 x 4	none	cassette	parallel, serial Teletalk included
69-key chiclet	LCD	31 x 1	none	cassette, opt. 48K wafertape	cartridge
54-key chiclet	composite	20 x 4	160 x 32	cassette (with interface)	expansion
54-key chiclet	LCD	12 x 1	none	cassette	expansion
54-key chiclet	LCD	24 x 1	none	cassette	expansion
54-key chiclet	LCD	12 x 1	none	cassette (with interface)	expansion built-in printer

Pocket Computers

Computer		Base Price	Micro-processor	Memory		Operating Systems	Languages	
Vendor	Model			RAM (min/max)	ROM		Standard	Options
Panasonic Indust. Co. 1 Panasonic Way Secaucus, NJ 07094 (201) 348-5200	Panasonic RL-H 1400	\$400	8-bit 6502	4/4K	16K	proprietary	none	Basic, SNAP, Forth
Tandy-Radio Shack 1500 1 Tandy Center Fort Worth, TX 76102 (817) 338-2394	TRS-80 PC-2	\$199.95	8-bit custom CMOS	16K	2/10K	proprietary	Basic	none
Tandy-Radio Shack 1500 1 Tandy Center Fort Worth, TX 76102 (817) 338-2394	TRS-80 PC-3A	\$99.95	custom	4/4K	1.4K	proprietary	Basic	none
Tandy-Radio Shack 1500 1 Tandy Center Fort Worth, TX 76102 (817) 338-2394	TRS-80 PC-4	\$69.95	custom CMOS	.5/1.5K	NA	proprietary	Basic	none



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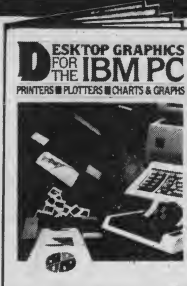
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Keyboard	Display		Storage	Interfaces	Notes
	Method of Display	Text Resolution			
65-key half-stroke	LCD	26 x 1	159 x 8	cassette	cartridge, expansion
65-key chiclet	LCD	26 x 1	156 x 7	cassette (with interface)	expansion
52-key chiclet	LCD	24 x 1	none	cassette (with interface)	expansion
53-key chiclet	LCD	12 x 1	none	cassette (with interface)	expansion

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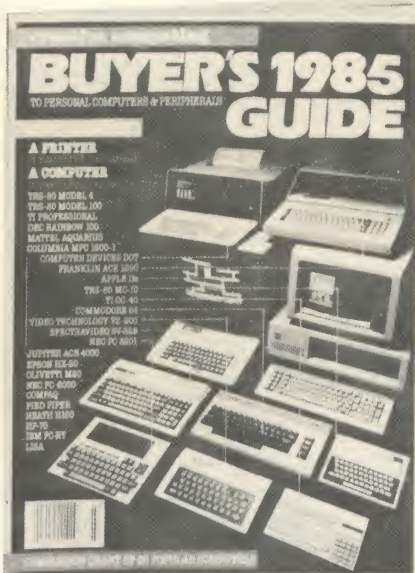
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Commodore/PET	C	N
Digital Equipment/DEC	D	O
Heath/Zenith	E	P
IBM	F	Q
Radio Shack/Tandy TRS-80	G	R
Texas Instruments	H	S
Timex Sinclair	I	T
Other (specify)	J	U
None	K	V

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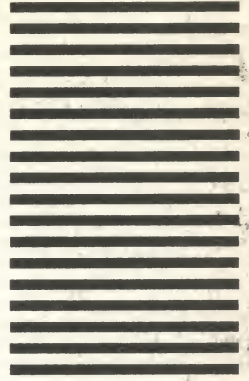
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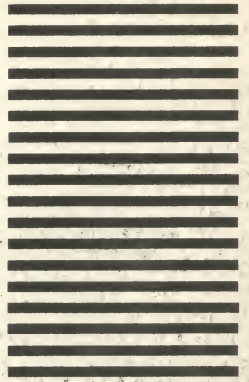
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